COLLEGE OF AGRICULTURE AND LIFE SCIENCES

ADMINISTRATION

Susan A. Henry, dean

William E. Fry, senior associate dean

John M. Finamore, associate dean for financial affairs

Mary Lou Doyle, assistant dean for human resources

Michael P. Riley, assistant dean for public affairs

H. Dean Sutphin, associate dean and director of academic programs

Donald R. Viands, associate director of academic programs

Daniel J. Decker, associate dean and director of the Cornell University Agricultural Experiment Station

Anthony M. Shelton, associate director of research

D. Merrill Ewert, associate dean and director of cooperative extension

Edward D. Harwood, associate director of cooperative extension

Margaret E. Smith Einarson, associate director of cooperative extension

Norman T. Uphoff, director of international agriculture

James E. Haldeman, associate director of international agriculture

Terry W. Tucker, associate director of international agriculture

Office of Academic Programs Staff

Counseling and advising: Lisa Ryan, Bonnie Shelley

Registrar: Mary Milks, Patricia Austic

Admissions: Robert Springall, Ann LaFave, Bernadette Soto, Bryan Nance

Career development: Amy Benedict-Augustine, Laurie Gillespie, Pamela Hampton

Minority programs: Catherine Thompson

Department Chairs

Agricultural and biological engineering: M. F. Walter, Riley-Robb Hall

Applied economics and management: A. M. Novakovic, Warren Hall

Animal science: A. W. Bell, Morrison Hall

Atmospheric science unit (part of earth and atmospheric sciences): S. J. Riha, Bradfield Hall

Biometrics: M. T. Wells, Ives Hall

Communication: R. E. Ostman, Kennedy Hall

Crop and soil sciences: S. D. DeGloria, Emerson Hall

Ecology and evolutionary biology: R. G. Harrison, Corson Hall

Education: D. E. Hedlund, Kennedy Hall

Entomology: D. A. Rutz, Comstock Hall

Food science: D. Miller, Stocking Hall

Horticultural science: H. C. Wien, Plant Science Building

Landscape architecture: Kennedy Hall

Microbiology: S. H. Zinder, Wing Hall

Molecular biology and genetics: D. I. Shalloway, Biotechnology Building

Natural resources: J. P. Lassoie, Fernow Hall

Neurobiology and behavior: C. Walcott, S. G. Mudd Hall

Plant breeding: Emerson Hall

Plant pathology: R. Loria, Plant Science Building

Rural sociology: P. D. McMichael, Warren Hall

Statistical sciences: B. W. Turnbull, Mallott Hall

College Focus

The College of Agriculture and Life Sciences provides educational programs that prepare men and women with technical, management, and leadership skills.

The college focuses on a broad-based education for its students, and on a problem-solving and basic research program. The program is geared to the discovery and dissemination of knowledge for the purpose of advancing the food system, agriculture, nutrition, biological sciences, environmental quality, and community and rural development throughout New York State, the nation, and the world.

There are six primary areas of focus, developed in response to the needs of society, and representing agriculture and life sciences in their broadest and most dynamic meaning:

- Agriculture (production and marketing)
- Biological Sciences
- Community, Human, and Rural Resources
- Environment
- Food and Nutrition
- International

Facilities

The College of Agriculture and Life Sciences is located on the upper campus, up the hill from the central area of Cornell University, on land that was once part of the Ezra Cornell family farm.

Buildings around the area commonly known as the Ag Quad house classrooms, offices, and laboratories. Flanking them are the greenhouses, gardens, and research facilities. Nearby orchards, barns, field plots, forests, and streams extend as far as the Animal Science Teaching Research Center at Harford and the Agricultural Experiment Station at Geneva.

Roberts Hall serves as headquarters for the administrative units, including offices of the deans and directors of academic programs, research, and cooperative extension. Included in the Office of Academic Programs are the director and associate director, the Admissions Office, the Career Development Office, the Counseling and Advising Office, the Office of Minority Programs, and the Registrar.

Mann Library, with its extensive collections of materials in the agricultural and biological sciences, is at the east end of the Ag Quad. The student lounge and service center, known as the Alfalfa Room, and many of the college classrooms are in Warren Hall. Public computer facilities are available in Warren Hall, in Riley-Robb Hall, and in Mann Library.

DEGREE PROGRAMS

The College of Agriculture and Life Sciences offers programs leading to the degrees of Bachelor of Science, Master of Science, and Doctor of Philosophy. Professional degrees include the Master of Professional Studies and the Master of Arts in Teaching. Some registered professional licensing and certification programs are also available.

Each curriculum in the college creditable toward a degree is registered with the New York State Education Department and is linked with the national Higher Education General Information Survey (HEGIS) codes for federal and state reporting.

Graduate Degrees

Graduate study is organized by fields that generally coincide with the academic departments but may draw faculty from several disciplines in the various colleges of the university. The following graduate fields have primary affiliation in Agriculture and Life Sciences. Current directors of graduate studies are also listed.

Agriculture [M.P.S. (Agr.)]: H. D. Sutphin, Roberts Hall

Agricultural and Biological Engineering: D. J. Aneshansley, Riley-Robb Hall

Agricultural Economics: R. N. Boisvert, Warren Hall

Animal Breeding: E. J. Pollak, Morrison Hall

Animal Science: R. L. Quaas, Morrison Hall

Atmospheric Sciences

Biochemistry, Molecular and Cell Biology: W. J. Brown, Biotechnology Building

Biometry: M. Wells, Warren Hall

Communication: J. E. Shanahan, Kennedy Hall

Development Sociology: C. C. Geisler, Warren Hall

Ecology and Evolutionary Biology: D. W. Winkler, Corson Hall

Education [also M.A.T.]: D. J. Trumbull, Kennedy Hall

Entomology: E. Shields, Comstock Hall

Environmental Toxicology: A. Yen, Rice Hall

Food Science and Technology: H. T. Lawless, Stocking Hall

Genetics and Development: K. J. Kemphues, Biotechnology Building

Horticulture: N. L. Bassuk, Plant Science Building

International Agriculture and Rural Development [M.P.S. (Agr.)]: R. W. Blake, Morrison Hall

International Development: N. T. Uphoff, Caldwell Hall

Landscape Architecture [M.L.A.], D. W. Krall, Kennedy Hall

M.P.S. Agriculture with Peace Corps Option (offered by most agriculture fields with M.P.S. programs): J. Haldeman, Warren Hall or see director of graduate studies for chosen field

Microbiology, S. C. Winans, Wing Hall

Natural Resources, M. E. Krasny, Fernow Hall

Neurobiology and Behavior, C. D. Hopkins, Seeley-Mudd Hall

Nutritional Sciences, M. N. Kazarinoff, Martha Van Rensselaer Hall

Physiology, S. S. Suarez, Vet Research Tower

Plant Biology, J. B. Nasrallah, Plant Science Building

Plant Breeding, M. E. Sorrells, Bradfield Hall

Plant Pathology, J. W. Lorbeer, Plant Science Building

Plant Protection [M.P.S. (Agr.)], Plant Science Building

Soil and Crop Sciences

Statistics, M. Wells, Malott Hall

Zoology, J. W. Hermanson, Schurman Hall

Bachelor of Science Degree

Departments in the College of Agriculture and Life Sciences sponsor study for the B.S. degree in 20 major programs. To qualify for the degree, students must fulfill requirements established by the faculty of the college and administered through the Office of Academic Programs. The following units offer major fields of study for undergraduates. A faculty advising coordinator is listed for each unit. Students should consult with the faculty coordinator regarding requirements and opportunities for concentrations in the major field.

Agricultural and Biological Engineering: Jim Bartsch, 314 Riley-Robb Hall

Applied Economics and Management: Dale Grossman, 204 Warren Hall

Animal Sciences: W. Bruce Currie, 434 Morrison Hall

Atmospheric Sciences: Dan Wilks, 1113 Bradfield Hall

Biological Sciences: Jeff Doyle, 200 Stimson Hall; Bonnie Comella, 216 Stimson

Biology and Society: Marta Weiner, 275 Clark Hall

Biometry and Statistics: Steve Schwager, 424 Warren Hall

Communication: Brian Earle, 328 Kennedy Hall

Crop and Soil Sciences: Ray Bryant, 705 Bradfield Hall

Education: George Posner, 416 Kennedy Hall

Entomology: Bobbie Peckarsky, 3134 Comstock Hall

Floriculture and Ornamental Horticulture: Ken Mudge, 20 Plant Science Building

Food Science: Janice Brown, 107 Stocking Hall

Landscape Architecture: Peter Trowbridge, 440 Kennedy Hall

Natural Resources: Tim Fahey, 12 Fernow Hall

Nutrition, Food, and Agriculture: Carole Bisogni, 334 MVR Hall

Plant Science Units (Plant Biology, Genetics and Breeding, Pathology/Protection, Pomology, Vegetable Crops): George Hudler, 315 Plant Science

Rural Sociology: Paul Eberts, 319 Warren Hall

Science of Earth Systems: Kerry Cook, 3114 Snee Hall

Special Programs in Agriculture and Life Sciences: Lisa Ryan, 140 Roberts Hall; Terry Tucker, 31 Warren Hall, for International Agriculture Program

Summary of Basic College Requirements for Graduation

1. **Credit Hours**

a. Minimum: 120

Exception: Credit for tutorial courses (Math 109, EDUC 005, and 00 level) **increase** the number of credits required for graduation by the number of credits in the course. The credits **do** count toward the minimum 12 credits for full-time status.

b. Minimum at Cornell: **60**; Maximum transferred in (C- or higher): **60**

c. Minimum from College of Agriculture and Life Sciences: **55** (includes credit used in the distribution and appropriate transfer credit)

d. Maximum from endowed colleges (Arts and Sciences; Architecture, Art, and Planning; Engineering; and Hotel School) without additional charge: **55** (includes credit used in the distribution **AND** failed courses)

e. Minimum with letter grade: 100; Maximum with S-U grade based on 120 credits: 20 (prorated for transfer students) with maximum of one course per semester

f. Maximum independent study, teaching experience, internships based on 120 credits: **15** (pro-rated for transfer students)

g. Credit for physical education **does not** count toward the 120 credits or the minimum 12 credits for full-time status (see #6).

2. **Residence**

a. Students are entitled to enroll eight full-time semesters (prorated for transfer students). A full-time semester requires a minimum of 12 credits per semester, **not** counting physical education. Tutorial courses (see #1A) **are** counted.

b. A minimum of seven semesters is required.

c. Internal transfer students must be enrolled in CALS for at least two semesters, **not** including residency in Internal Transfer Division.

d. The final semester before graduation **must** be in residence at Cornell as a full-time student in good academic standing.

Exception: Students with eight or fewer credits remaining for graduation and with circumstances that prevent full-time study may petition for approval to complete remaining credits at another institution or part-time in CALS.

3. **Grade-point Average (GPA)**

Cumulative GPA: 2.00 or above must be maintained. Includes only grades earned at Cornell after matriculating into the college.

For students matriculated prior to 8/01: Cumulative GPA: 1.70 or above must be maintained. Includes only grades earned at Cornell after matriculating into the college.

4. **Distribution**

The purpose of the distribution requirement is to provide a broad educational background and to ensure a minimum level of competency in particular skills. Through study of the physical sciences, students develop quantitative and analytic skills based on an understanding of the physical laws governing the universe and through study of the biological sciences, they gain an appreciation of the variability of living organisms. The social sciences and humanities give students perspective on the structure and values of the society in which we live, and prepare them to make decisions on ethical issues that will affect their work and role in society. Through development of written and oral expression skills, students master the essentials of effective communication.

Credits received for independent study, field, teaching, work experience, and internships cannot be used to fulfill the distribution requirement. Courses judged to be remedial in the discipline, such as Education 005, will not be counted.

Group A: Physical Sciences. 9 credits of 100- or 200- level courses, in at least two disciplines, including at least one course in chemistry or physics.

Chemistry
Physics
*Mathematics (excluding Education 005, Mathematics 103 and 109)
Education 115
Earth and Atmospheric Sciences (SCAS) 131, 260
Crop and Soil Sciences (SCAS) 260
Astronomy
Geology
Statistics and Biometry (including AEM (ARME) 210, ILRST 210)

*The college mathematics requirement is described below.

Group B: Biological Sciences. 9 credits, to include 6 of introductory biological science (introductory courses include BIO G 101–104, 105, 106, 109, 110.)

Biological Sciences (excluding 160, 200 [unless permission of the director of Undergraduate Biology is obtained], 202, 209, or 367)

Animal Sciences 100, 110, 221, 300, 301
Crop and Soil Sciences (SCAS)/Horticulture 366
Entomology 212
Nutritional Sciences 262
Plant Breeding 201, 225
Plant Pathology 309, 401

Group C: Social Sciences and Humanities. 12 credits (6 in each of the following two categories):

Social Sciences. 100- through 400-level courses in the following departments (*excluding* Freshman Seminars):
American Indian Studies 401
Anthropology
Archaeology
AEM (ARME) 416
Communication 116, 120, 410, 418, 420, 422
Economics (excluding all AEM (ARME) courses)
Education 271, 311, 317, 370, 378
Government
HD 150 (cannot receive credit for this course and Soc 151)
LA/CRP 261, 360, 363
Psychology (except 111)
S & TS 324, 350, 390, 391, 400, 401, 406, 407, 427, 442, 467, 483
Sociology (includes Rural Sociology except RS 100, 175, 305, 311, 318, 325, 333, 442)

Humanities. 100- through 400-level courses in the following departments (*excluding* Freshman Seminars and language courses):
Africana Studies (literature and history)
Asian American Studies
Asian and Near Eastern Studies (literature and history)
Classics (literature and history)
Comparative Literature
English (*literature only*)
French, German, Italian, Russian, and Spanish (*literature only*)
History
History of Art/History of Architecture
LA 282
Music and Theatre Arts (theory, literature, and history only)
Natural Resources 212, 407, 411
Philosophy
Religious Studies
Rural Sociology 100, 175, 318, 442
S & TS 205, 206, 233, 250, 281, 282, 286, 292, 360, 381, 433, 444, 447, 490
Women's Studies 444

Group D: Written and Oral Expression. 9 credits, of which at least 6 must be in written expression, selected from the following:

Written Expression
Freshman Seminars
Communication 117, 350, 352, 260 (was 360), 263 (was 363), 365
Education 100
English 280–281, 288–289, 382–385, 388–389

Oral Expression
Comm 201, 203

Students scoring 4 or 5 on the English advanced placement exam may be awarded three credits which will be recorded in Group D.

5. **Math Requirement**

Faculty legislation requires minimum competency in mathematics to complete a degree in the College of Agriculture and Life Sciences. As a measure of competency in mathematics, all entering undergraduates, including those with advanced placement or transfer credit in calculus, must take the college math proficiency exam (administered during orientation). The following students are exempt from the CALS Math Placement Exam: 1.) internal transfer students who already have passed one math course listed below under Group II section 1, and 2.) entering ABEN students (who take the placement exam in the College of Engineering).

The CALS exam score determines the college math graduation requirement, and provides placement information. The exam has two components. Cut-off scores divide students into three groups, each with specific graduation requirements.

Mathematics requirements and placement suggestions:

Group I Students in this group are considered proficient in math for college graduation requirements. If further math is needed for the major, placement score *suggests* calculus skill level (e.g., Math 111, 191, 193).

Group II Placement score suggests precalculus skill level, and students in this group must satisfy one of the following:

(1) Successfully complete an approved mathematics or statistics course at Cornell. EDUC 115 is recommended. Other approved courses are any mathematics course (except for Math 103, 109); AEM (ARME) 210; BTRY 100, 101, 102, 201, 261, 302; ILRST 210, 211, 310, 311, 312, 313, 314; ENGRD 270.

(2) Successfully complete or have completed an approved calculus course at another college or university with a final grade of B- or better.

(3) Receive AP credit for calculus or statistics.

Group III Students in this group must successfully complete an approved mathematics or statistics course at Cornell (see list in Group II above). Prior completion of EDUC 005 may be recommended at the discretion of the student's academic adviser.

Transfer and AP math credit (up to six) will be recorded in Group A of the college distribution requirements. Additional transfer credit in math will be recorded as general electives. ABEN students typically receive fewer AP credits than other CALS students with the same scores. ABEN students also may receive AP credits based on the Engineering math placement exam.

6. **Physical Education**

a. Pass a required swim test, administered during orientation.

b. Two courses with a satisfactory grade (courses do **not** count toward 120 credits for graduation or the minimum 12 credits for full-time study).

c. Students are expected to complete the physical education requirement in their first two semesters at Cornell.

d. Transfer students are credited with one course of physical education for each semester previously enrolled **full-time** (12 or more credits) at another college.

Faculty Advising

a. Each student is assigned to a faculty adviser soon after being admitted to the college. The faculty adviser will help the student plan a program of study of courses appropriate to the degree programs offered by the college.

b. Course enrollment each semester should be planned in consultation with the faculty adviser. Students pre-enroll for courses by computer through CoursEnroll, under courses, classes, and exams on the Bear Access menu. Pre-enrollment by computer is not valid until the student's individual code is entered. This code, or adviser key, is provided to the student by the faculty adviser after approval of the choice of courses.

c. All academic plans, such as acceleration and graduate study, should be made in consultation with the student's faculty adviser. Support of the adviser is essential if a student petitions for an exception to any of the requirements of the college.

Progress toward the Degree

a. The progress of each student toward meeting the degree requirements is recorded each term in the college registrar's office on a *Summary of Record* form.

b. Students who have been in residence for eight semesters and who have met the graduation requirements will be graduated. Students are entitled to attend for the full eight semesters even if they have completed the graduation requirements in fewer semesters. A student who wishes to continue study after graduation must apply for admission as a special student through the college admissions office, 177 Roberts Hall.

c. Application to graduate. Students who are planning to graduate must complete an "Application to Graduate" by the end of the fourth week of classes in the spring semester for May graduates or in the fall semester for January graduates. The adviser signs the application after verifying that the requirements for the major have been completed. The college registrar signs after verifying that the college requirements will be fulfilled after successful completion of the student's final semester.

Credit Earned While in High School

Transfer credit will *not* be accepted for the Syracuse Project Advance Program and similar programs. If a student is enrolled in a college/university course during his/her high school years, transfer credit will be given *only* if certain criteria are met:

1. Course must be a standard course taught by a post-secondary institution.
2. High school must be a satellite location, one of several options available to *all* students taking the course.
3. Course syllabus, text, examinations, and evaluation process must be the same for *all* students at *all* sites.
4. Students must be enrolled for college credit and pay college tuition.
5. Instructor must be a faculty member (includes adjunct) at the offering college.

If one of these is not met, no transfer credit will be given. Written verfication may be necessary.

CLEP Credit

The College of Agriculture and Life Sciences awards CLEP (College-Level Examination Program) credit if a student achieves an acceptable score on the CLEP exam. Please contact the Registrar's Office in 140 Roberts Hall for specific information about CLEP credit.

STUDENTS

Undergraduate enrollment is approximately 3,100, with about 56 percent in the upper division. Each year about 850 students are graduated, while 635 freshmen and 250 new transfer students are enrolled. College faculty members serve as chairs of the special committees of roughly 1,100 graduate students.

Admission

The College Admissions office selects applicants who are academically well prepared and appear most likely to benefit from the college's various curricula.

While most students come from New York State, about 30 percent come from other parts of the United States or abroad. Slightly more than half of the undergraduates are women. Approximately 22 percent are self identified as members of minority ethnic groups.

Transfer Students

Approximately 18 to 20 percent of ALS undergraduate students are transfers who have completed part of their collegiate work at community colleges, agricultural and technical colleges, or other four-year institutions. Many of them hold an associate degree.

A Cornell student in good standing may apply for an intra-university transfer to pursue a course of study unavailable in his or her current college. Guidelines are available in the Admissions Office of the College of Agriculture and Life Sciences, 177 Roberts Hall. The procedure involves filing a transfer request, meeting with a faculty member in the proposed area of study and submitting a letter of explanation for the transfer.

Consideration is given to students who have demonstrated an interest in their proposed field of study, by taking appropriate prerequisite courses and courses within the area of study. Academic achievement is also considered. Students are seldom allowed to transfer during their freshman year. In certain cases a student may be referred to the Internal Transfer Division (ITD) to study for one semester before entering the college. A second semester in ITD is considered only in unusual circumstances. During this trial semester the student must achieve a predetermined average (usually 2.7) and take approved courses to assure acceptance.

Special Students

A limited number of non-degree candidates who want to take courses in the college are admitted each year. Applicants should submit the standard Cornell application, a resume of their work experience, and a list of the courses in which they are interested. For more information and guidelines, students should contact the Admissions Office, 177 Roberts Hall.

Off-Campus Students

Programs in which students study off campus but enroll for Cornell credit include SEA semester, field study in human ecology or industrial and labor relations, Albany programs, Cornell-in-Washington, student teaching, IPM internship, and clinical microbiology internship. **Students intending to receive Cornell credit for work done off campus should inform the college registrar at the time of enrolling for courses to ensure that proper registration will occur.**

Off-Campus Courses

Students in CALS must be registered for at least 12 credits of course work each semester. It is expected that students will not be enrolled in course work at another institution while they are enrolled at CALS.

Two exceptions to enrollment elsewhere while being a full-time student at Cornell would be the joint enrollment agreements between Cornell and Ithaca College and Wells College. Other exceptions must be reviewed by the Committee on Academic Achievement and Petitions. Students must petition *before* enrolling for a course elsewhere. The committee may approve such petitions only when there are compelling circumstances such as severe scheduling problems or no equivalent course available at Cornell. Enrolling in a course at another college to avoid taking it at Cornell is not permitted.

Leave of Absence

A student wishing a break from studies in a future semester, or those who find it necessary to leave the university before the end of a semester, should submit a written petition for a leave of absence. Such action is necessary to clear the record for the semester and if not taken may adversely affect the student's subsequent readmission to the university.

An approved leave is considered a voluntary interruption in study and holds the student's place in the college without requiring reapplication to the university. Voluntary leaves are issued two ways: unrestricted for students in good academic standing (no restrictions placed on length of leave, activities pursued, and simple notification by student of intent to return), and restricted (length of leave and activities pursued may be specified, and a petition to return must be approved by the Petitions Committee).

A database is maintained by the Counseling and Advising Office to assist participation in pre-course enrollment the semester before a student's return.

Information and petition forms are available in the Counseling and Advising Office, 140 Roberts Hall.

Withdrawal

A student who wishes to leave the university permanently should file a petition for withdrawal. Such petitions are approved if the student is in good academic standing. Students who have withdrawn and who later decide to return must apply to the Admissions Office.

Graduation and Diplomas

Graduating seniors must complete the Application to Graduate (see the details in Part C of "Progress toward the Degree"). Diplomas are distributed to those who have completed the degree requirements and have been approved by the college faculty. After the commencement ceremony at Schoellkopf Field in May, graduates return to the Ag Quad to obtain their diplomas. For January and August graduates, diplomas are mailed.

ADVISING AND COUNSELING SERVICES

Faculty members in the College of Agriculture and Life Sciences recognize that students need information and advice to make intelligent decisions while in college. They believe that personal contact is the best way to provide information and advice on both academic and personal matters; they consider advising to be an important and integral part of the undergraduate program. Each student enrolled in the college is assigned to a faculty adviser in his or her major field of study for assistance and guidance in developing a program of study, and to enhance the student's academic experience.

The Counseling and Advising Office coordinates the faculty advising program, serves as the college's central undergraduate advising office, and offers personal counseling. Academic advising is available for students who are interested in international study, need to file petitions to waive college academic regulations, have disability concerns, are experiencing academic difficulties, or have requests for tutoring. The staff coordinates new student orientation, award ceremonies, commencement activities, and the activities of Ho-Nun-De-Kah, the college's honor society. Students seek counseling and advising on a variety of issues including academic problems, course problems and college procedures, graduation requirements, personal and family problems, stress management, and time management. Two counselors provide short-term counseling with an expertise in college policies and guidelines. Counseling is framed as appropriate to each student's academic circumstances. The staff is available on a walk-in basis, as well as by appointment.

The Office of Minority Programs serves to recruit, admit, monitor, and influence policy on behalf of all minority students in the College of Agriculture and Life Sciences. This population is defined as encompassing all African American, Latin American, Asian American, and Native American students. In the past academic year, this population represented approximately 20 percent of the college's undergraduate population. Additionally, the office is charged with monitoring and programming for the Educational Opportunity Program (EOP) and the Prehealth Collegiate Science and Technology Entry Program (CSTEP). EOP and CSTEP are state-supported programs intended to assist New York State students who meet economic and academic criteria set by the college, State Programs Office, and New York State Board of Regents. For further information, please contact Catherine Thompson in 140 Roberts Hall.

Within the university, the Office of Minority Programs is charged with acting as the college

liaison with the central Office of Minority Education Affairs, the Learning Strategies Center, and the State Programs Office. Other university connections include the Undergraduate Admissions Office and the Office of Financial Aid regarding the concerns of the minority student population. The director, assistant director, and 7 to 10 peer advisers primarily carry out the duties of the Office of Minority Programs. Together, the staff acts as a major advocacy and advising group, as well as an informational and referral center. The director and assistant director provide support for the Academic Human Diversity and Resources Committee. Its constituency includes students, faculty, and the general public.

Given the college's policy on non-exclusionary programming, the Office of Minority Programs is also responsible for some functions that serve the college's entire population. Presently, that includes reviewing non-minority applicant folders, serving as the Prehealth Program adviser and liaison, and providing ongoing support at all levels for the Office of Counseling and Advising.

The Office of Career Development offers a variety of helpful services to all students and alumni of the college. Career development includes self-assessment, career exploration, decision making, and transition to employment or further study. Services are designed to assist students and alumni with those activities and to help them develop the career planning and job search skills they will find useful as their career paths progress and change.

The Career Library contains an extensive collection of current and useful material, including career information books, extensive internship files, employer directories, and job listings. Alumni Career Link is a database of 300 college alumni who have offered to help students and alumni with their career development in a variety of ways. Job search talks on topics such as resume writing, cover letter writing, and interview skills are presented throughout the semester and are available on videotape. An active on-campus recruiting program brings more than 90 employers to campus each year to interview students for full-time and summer jobs. Additionally, the office provides information on hundreds of internships.

The office, in conjunction with a network of college faculty and staff members, assists students throughout their undergraduate years and beyond. For further information, students should contact Amy Benedict-Augustine and the staff in 177 Roberts Hall.

Financial aid is administered through the university office in Day Hall. Endowment funds and annual donations provide supplemental aid for students in the college who are eligible for financial aid. Information about these college grants is available from the Office of Academic Programs in Roberts Hall for students who have their financial aid package established through the university office in Day Hall. Grants are processed through the university's Office of Financial Aid.

Academic Integrity Policy

The College of Agriculture and Life Sciences faculty, students, and administration support and abide by the university Code of Academic Integrity. Its principle is that absolute integrity is expected of every student in all academic undertakings: students must in no way misrepresent their work, fraudulently or unfairly advance their academic status, or be a party to another student's failure to maintain academic integrity.

The maintenance of an atmosphere of academic honor and the fulfillment of the provisions of the code are the responsibility of the students and the faculty. Therefore, all students and faculty members shall refrain from any action that would violate the basic principles of this code.

1) Students assume responsibility for the content and integrity of their submitted work, such as papers, examinations, or reports.
2) Students are guilty of violating the code if they
   - knowingly represent the work of others as their own
   - use or obtain unauthorized assistance in any academic work
   - give fraudulent assistance to another student
   - fabricate data in support of laboratory or field work
   - forge a signature to certify completion or approval
   - submit the same work for two different courses without advanced permission
   - knowingly deprive other students of library resources, laboratory equipment, computer programs, or similar aids
   - in any other manner violate the principle of absolute integrity
3) Faculty members assume responsibility to make clear to students and teaching assistants specific regulations that apply to scholarly work in a discipline.
4) Faculty members fulfill their responsibility to
   - maintain in all class, laboratory, and examination activities an atmosphere conducive to academic integrity and honor
   - make clear the conditions under which examinations are to be given
   - make clear the consequences of violating any aspects of the code
   - provide opportunities for students to discuss the content of courses with each other and help each other to master that content and distinguish those activities from course assignments that are meant to test what students can do independently
   - state explicitly the procedures for use of materials taken from published sources and the methods appropriate to a discipline by which students must cite the source of such materials
   - approve in advance, in consultation with other faculty members, which work submitted by a student and used by a faculty member to determine a grade in a course may be submitted by that student in a different course
   - monitor the work and maintain such records as will support the crucial underpinning of all guidelines: the students' submitted work must be their own and no one else's

Cornell's Code of Academic Integrity spells out how individuals who have allegedly violated Cornell standards for academic integrity are to be confronted and, if found to be in violation of those standards, sanctioned. The code provides informal resolution of most perceived violations through a primary hearing between the faculty member, the student involved, and an independent witness. If necessary, a hearing before a hearing board follows.

The Academic Integrity Hearing Board for the College of Agriculture and Life Sciences consists of three elected faculty members, three elected student members, a chair appointed by the dean, and the director of counseling and advising, who serves as a non-voting record keeper. Professor Dale Grossman is the current chair.

Individuals who observe or are aware of an alleged violation of the code should report the incident to the faculty member in charge of a course or to the chair of the hearing board. General information and details on procedures for suspected violations or hearings are available from the Counseling and Advising Office, 140 Roberts Hall.

ACADEMIC POLICIES AND PROCEDURES

Records

The college registrar maintains a complete academic record for each matriculated student. The director of enrollment management and student records, registrar, and associate registrar are available to consult with students regarding the assignment of credit toward meeting distribution and elective requirements as listed on the *Summary of Record* form.

Registration Procedures

All students must register with the university *and* check-in with this college at the beginning of each semester. Check-in materials are available in 140 Roberts Hall as announced each term by the university registrar.

Course Enrollment Procedures

To enroll in courses, students will receive information from the university registrar; plan a schedule in consultation with their adviser; and pre-enroll by computer, through CoursEnroll in "Just the Facts" on the Bear Access menu. Pre-enrollment is not valid until the student enters the adviser key code into the computer. Adviser key codes are provided by faculty advisers after a discussion of selections and requirements takes place. The adviser key code changes each semester to ensure ongoing contact between student and faculty adviser.

To enroll in courses that involve independent study, teaching, or research, a student must file an independent study form, available in the college Registrar's Office, 140 Roberts Hall. Students who will be studying off campus should notify the Registrar's Office to ensure that proper registration will occur.

Students may enroll again for a course in which they received a grade of F in a previous semester. Both grades will be recorded and calculated as part of their GPA. If a student retakes a course in which a passing grade was earned, the second time will be for no credit.

Students must *not* enroll again for a course in which they received an incomplete or NGR. Instead, work for that course should be completed without further enrollment. The instructor files a manual grade form to the college registrar when a grade has been assigned. An incomplete not made up by the end of two successive semesters of residence reverts to a failure. In the case of a graduating senior, incompletes revert to failures at the time of graduation.

Students enrolled in a two-semester course will receive an R at the end of the first semester and should enroll again for the same course the second semester. The letter grade will be recorded for the second semester when all work for the course is completed. A note on the transcript will explain the R grade.

A student is held responsible for and receives a grade for those courses in which he or she enrolls unless the student officially changes such enrollment. All changes in courses or credit, grading options, or sections must be made by the student at the Registrar's Office, 140 Roberts Hall, on the official university course drop and add form. Approval and signature of the faculty adviser and course instructor are required to change course enrollment.

Students may add courses and change grading options or credit hours where applicable during the first three weeks of the term, and may drop courses until the end of the seventh week.

Students wishing to withdraw from a course after the end of the seventh week must petition to the college Committee on Academic Achievement and Petitions (also see Petitions Procedures below). Petition forms are available in Counseling and Advising, 140 Roberts Hall. Requests for course changes are approved only when the members of the committee are convinced that unusual circumstances are clearly beyond the control of the student. The committee assumes that students should have been able to make decisions about course content, total workload, and scheduling prior to stated deadlines. A grade of W (for "withdrawal") is recorded on the transcript if a petition to drop a course is approved after the end of the seventh week of classes, and if an approved drop results in fewer than twelve credits.

Petitions Procedures

The Committee on Academic Achievement and Petitions is a college committee of six faculty and two student members. On behalf of the faculty, the committee

- reviews, at the end of each semester and at other times as shall seem appropriate to the committee, the progress of students toward meeting graduation requirements
- receives and acts upon petitions from individual students asking for exceptions from particular academic regulations or requirements of the college, or for reconsideration of action previously taken by the committee
- acts upon readmission requests from persons whose previous enrollment was terminated by the committee
- notifies the petitioner in writing of the action taken by the committee

A petition for exemption from a college academic requirement or regulation may be filed by any student who has grounds for exemption. Forms are available in the Counseling and Advising Office, 140 Roberts Hall. Counselors are available to assist with the process.

A petition is usually prepared with the assistance of a student's faculty adviser, whose signature is required. The adviser's recommendation is helpful to the committee. The committee reviews the written petition and determines whether there is evidence of mitigating and unforeseen circumstances beyond the control of the student that would warrant an exemption or other action. Petitions for withdrawing from a course are discussed above.

Academic Deficiency Policies

At the end of each semester, the Committee on Academic Achievement and Petitions reviews the records of those students who in any respect are failing to meet the academic requirements of the college or who persistently fail to attend classes. For students not making satisfactory progress, the committee takes appropriate action, including, but not limited to, issuing warnings, placing students on probation, granting students leaves of absence, advising students to withdraw, suspending or expelling students.

Specifically, the committee considers as possible cause for action, failure to attend and participate in courses on a regular basis or, at the end of any semester, failure to attain one or more of the following:

- semester GPA of at least 2.0*
- cumulative GPA of at least 2.0*
- satisfactory completion of 12 or more credits per semester
- reasonable progress toward completion of distribution requirements
- appropriate completion of college and university requirements

In general terms, regular participation in course work with academic loads at a level sufficient to assure graduation within eight semesters and grades averaging C (2.0) or higher are prima facie evidence of satisfactory progress and good academic standing.

*For those students matriculating 8/01 or later. Requirements are 1.70 for those who matriculated prior to 8/01.

Grade Reports

Grade reports for the fall semester are available on "Just the Facts" in January; grade reports for the spring semester are mailed by the Office of the University Registrar to students at their home addresses unless alternative addresses are reported to the college or university registrar by mid-May.

ACADEMIC HONORS

The college encourages high academic achievement and recognizes outstanding students in several ways:

Dean's List. Each semester, students are recognized for academic excellence by inclusion in the Dean's List. Eligibility for the Dean's List in the College of Agriculture and Life Sciences is determined by the following criteria:

1) a minimum course load for the semester of 12 letter-graded credits;
2) achievement of a semester GPA of at least 3.50; and
3) achievement of an 'S' grade, or a 'C-' or better grade in each course (including physical education), with no Incompletes. Dean's List will be granted retroactively if students meet all the requirements after successful course completion to make up INC grades.

Bachelor of Science with Honors. Students receiving a cumulative GPA of 4.0 or greater (based on the last four full-time semesters of Cornell credits in residence, with a minimum of 48 letter graded credits) will graduate "summa cum laude."

Students receiving a cumulative GPA of greater than or equal to 3.75 and less than 4.0 (based on the last four full-time semesters of Cornell credits in residence, with a minimum of 48 letter graded credits) will graduate "magna cum laude."

Students receiving a cumulative GPA of greater than or equal to 3.5 and less than 3.75 (based on the last four full-time semesters of Cornell credits in residence, with a minimum of 48 letter graded credits) will graduate "cum laude."

Bachelor of Science with Distinction in Research. Students will graduate with a bachelor of science degree with distinction in research when, in addition to having completed all the graduation requirements, they have satisfactorily completed the research honors program in their area of interest and have been recommended for the degree by the honors committee of that area. Special requirements are given in the section on the Research Honors Program.

Ho-Nun-De-Kah, founded in 1929, is the undergraduate honor society of the College of Agriculture and Life Sciences. Members are recruited from the top 20 percent of the senior class and top 15 percent of the junior class. In keeping with the ideals of encouraging scholarship, leadership, and citizenship, members provide free tutoring and a variety of service activities to both the college and the community.

Gamma Sigma Delta is an honor society of faculty and students in the Colleges of Agriculture and Life Sciences, Human Ecology, and Veterinary Medicine. The common bond is promotion of excellence in work related to the quality of our environment and life as it relates to agriculture and the related sciences. The Cornell chapter recognizes the academic achievements of students, faculty, and alumni of those colleges with nominations for membership and with special awards. To be eligible, seniors must be in the upper 15 percent of their major. Five juniors with the highest grade point average in the college are also nominated. Gamma Sigma Delta also

promotes academic excellence through sponsorship of special programs in the three colleges.

Golden Key is a National Honor Society that recognizes and encourages scholastic achievement and excellence in all undergraduate fields of study. Juniors and seniors with a cumulative GPA of 3.66 or higher are eligible. Visit Golden Key's web site at gknhs.gsu.edu/

RESEARCH HONORS PROGRAM

The Research Honors Program provides students with a special opportunity to work with a faculty mentor to experience the research process. Successful completion of this program requires a thesis written in the style of a master's thesis or professional journal in that area of research. Original research often is published in a professional journal. During the summer of each year, a *CALS Research Honors Proceedings* is published as a compilation of abstracts of the honors theses. Students are required to send an electronic version of their thesis title, abstract, student's name, and the research adviser's name to Ann Gantner, amg28@cornell.edu, by the end of the spring semester.

The Bachelor of Science degree with "distinction in research" is conferred upon those students who, in addition to having completed the requirements for the degree of Bachelor of Science, have satisfactorily completed the honors program in their area of major interest and have been recommended for the degree by the honors committee of that area.

Research may be done under the appropriate program area: Animal Sciences, Biological Sciences, Biology and Society, Entomology, Natural Resources, Nutritional Sciences, Physical Sciences, Plant Sciences, and Social Sciences. Each program area has its own requirements in addition to the college requirements. After reviewing the requirements of each program area (below), students' questions may be directed toward the appropriate program area chair.

Consult "Undergraduate Research Opportunities" on the web (http://www.cals.cornell.edu/stud_research/) for information about identifying a research topic, conferring with faculty, and undergraduate funding opportunities.

College Requirements

An undergraduate wishing to enroll in the honors program must have completed at least 55 credits, at least 30 of those 55 at Cornell. Also, the student must have attained a cumulative Cornell GPA of at least 3.0 (unless otherwise noted by a particular program) at the time of entry.

Interested students must make written application no later than the end of the sixth week of the first semester of their senior year, but are encouraged to make arrangements with a faculty member during the second semester of their junior year (or earlier if required by the program area). For most of the program areas, an application form is available from the college registrar in 140 Roberts Hall. The application form also can be printed from the web at http://www.cals.cornell.edu/oap/registrar/HonorMainWebPage.htm. Applications for Biological Sciences students can be picked up at 200 Stimson Hall, and for Biology and Society students at 275 Clark Hall.

Before the completed application is returned to the registrar, signatures of approval are required in the following order: your faculty research mentor, your academic adviser, and the research honors program area chair. After the college registrar verifies the student's GPA, the student will be officially enrolled in the honors program. Additional requirements for application and completion of the program are described under each particular program area.

Academic credit may also be earned by enrolling in an appropriate independent study course (required by some program areas). When applying for admission to the program, the student may, if appropriate, submit a budget and a modest request for funds (up to $350) to cover some of the costs the student incurs in doing the research. If approved, the funding will be transferred from an account in the CALS Office of Academic Programs to a departmental account for the student's research adviser. The research adviser will use this funding to support the student's research. This funding is not to be used as salary for the student. Additional funding opportunities are described on the Undergraduate Research Opportunities web site.

Unless otherwise indicated in the following program area descriptions, the research report in the form of a thesis or journal article should be submitted to the research program committee no later than four weeks before the end of classes of the semester in which the student expects to graduate. Students in the College of Agriculture and Life Sciences wishing to participate in the research honors program must be accepted in one of the program areas approved by the faculty. Students are not eligible for distinction in research by participating in a program offered by another college or administrative unit.

The research honors committee for each program area recommends to the college registrar those students who qualify for honors. Only those who maintain a GPA of at least 3.0 will be graduated with "distinction in research."

For more information, consult the web at http://www.cals.cornell.edu/oap/registrar/HonorMainWebPage.htm

Animal Sciences

Faculty committee: W. B. Currie, chair; Y. R. Boisclair, S. M. Quirk, P. A. Johnson, P. Schofield

The objective of the animal sciences research honors program is to provide outstanding undergraduates with the opportunity to pursue supervised independent research and to develop an awareness of the scientific process. It is expected that the research will require significant effort and creative input by the student in its design and execution and in the reporting of the results.

Those students with majors in animal sciences who are interested in doing a research project should consult with their faculty advisers early in their junior year. All students are expected to meet the college requirements in qualifying for the program and to complete the following:

- Identify a potential research honors project sponsor (i.e., a faculty member working in the animal sciences) and secure that faculty member's commitment to sponsor the student in the research project. This should be accomplished early in the second semester of the junior year.
- Preregister during the spring semester for AS 495, Animal Sciences Honors Seminar, which is offered in the fall semester.
- Register for AS 499, Undergraduate Research.
- Participate in AS 402, Seminar in Animal Sciences, during the spring semester and report on and discuss the project and results (see exceptions under particular program areas).
- Submit a written thesis to the Animal Sciences Research Honors Committee by the scheduled deadline. Specific information regarding deadlines, format, and organization for the thesis will be provided.
- Meet with the Research Honors Committee for a short oral defense of the thesis following a review of the thesis by the student's sponsor and the research committee.

Details pertaining to the specific requirements of the program can be obtained from the office of the committee chair, 434 Morrison Hall.

Biological Sciences

Students interested in the research honors program in the biological sciences should consult with their faculty advisers and with potential faculty, research sponsors early in their junior year. See "Independent Research and Honors Program" in the Biological Sciences section of this catalog for complete details. Information on faculty research, applications, and program requirements may be obtained from the Office of Undergraduate Biology, 216 Stimson Hall.

Biology & Society

Faculty committee: D. Pimentel, chair

The research honors program in Biology & Society is designed to provide independent research opportunities for academically talented undergraduate students in Biology & Society. Students who enroll in this program are expected, with faculty guidance, to do independent study and research dealing with issues in biology and society. Students participating in the program should find the experience intellectually stimulating and rewarding whether or not they intend to pursue a research career.

Biology & Society students are considered for entry into the research honors program at the end of the second semester of the junior year. Application forms for the program are available in the Biology & Society Office, 275 Clark Hall. To qualify for the Biology & Society research honors project, a student must have an overall Cornell cumulative GPA of at least 3.3, have formulated a research topic, and have found a project supervisor (with a Cornell academic appointment) and a Biology & Society faculty member willing to serve as his/her adviser. The director of undergraduate studies will appoint a third reader of the completed research thesis. Applications will be reviewed by a committee

headed by the director of undergraduate studies, who will notify students directly of the outcome. Students will be permitted to register for the research honors program only by permission of the Biology & Society program. Students must enroll for two semesters and may take three to five credits per semester up to a maximum of eight credits in B&SOC 498 and 499, Honors Project I and II. More information on the honors program is available in the Biology and Society Office, 275 Clark Hall (255–6047).

Important Deadlines

(NOTE: If the following dates fall on a weekend, the deadline is the preceeding Friday).

- Last week of second semester of the junior year: Application for honors program submitted to 275 Clark Hall.
- April 15: Thesis completed in a form satisfactory for evaluation and submitted to the three readers.
- April 29: Thesis defense accomplished.
- May 13: Two bound copies of completed and defended thesis submitted to director of undergraduate studies.

Entomology

Faculty committee: B. L. Peckarsky, chair

A research honors program in the area of entomology may be pursued by any qualified student in the College of Agriculture and Life Sciences. The student need not be specializing in entomology. Insects, because of their variety, small size, and easy availability, are convenient subjects for studying a wide array of problems dealing with living systems. Short life cycles, unique physiologies and developmental patterns, and species with easily managed colony requirements and a wide range of behavioral traits provide the raw material for research honors study. Cornell's diverse faculty interests and extensive collections and library in entomology are also major assets for students selecting entomology as their area for research honors study.

Research Honors students have the option of earning academic credit by enrolling in Independent Study (ENTOM 497) during any semester while working toward a Research Honors Thesis. Credits and grade option for satisfying requirements of ENTOM 497 should be discussed with the thesis adviser (see below.) Note: Enrolling in independent study is not a requirement for graduating with distinction in research honors in Entomology.

The Entomology Research Honors Committee requires that an undergraduate who is interested in embarking on a research honors project proceed with the following steps:

- Discuss the matter with his or her academic adviser, preferably in the junior year. This schedule makes it possible to carefully plan a research project, and implement some research during the junior year and/or summer before the senior year.
- Select an appropriate faculty member in the Department of Entomology who can serve as a supervisor to oversee the honors research. This need not be the student's academic adviser. The academic adviser will be of assistance in determining which faculty entomologist has expertise most compatible with the interests of the student.
- Prepare a brief, tentative plan of the project for the discussion and approval of the honors project supervisor. The plan should include a statement of objectives or hypotheses, proposed methods for testing hypotheses, needs for laboratory space or shared equipment, and a budget outlining financial support needed for travel and supplies.
- Submit a completed application and proposal (approved by the honors project supervisor and the chair of the Entomology Research Honors Committee) no later than the end of the sixth week of the first semester of the senior year. Earlier submission is encouraged. Applications are available and should be submitted to the CALS Registrar 140 Roberts Hall. These applications include an opportunity to request a modest amount of funding from the CALS honors program. These funds are distributed only once a year (in late fall).
- Submit a brief progress report, approved by the project supervisor, to the Entomology Research Honors Committee by midterm of the semester in which the student will complete his or her graduation requirements.
- Present a formal seminar reporting the significant findings of the research to the Department of Entomology (as a Jugatae seminar) in the last semester of the senior year.
- Submit two copies of the final honors thesis (as approved by the thesis supervisor) to the chair of the Entomology Research Honors Committee no later than two weeks before the last day of classes in the semester in which the student anticipates graduation. The thesis will be reviewed by the faculty honors project supervisor and one other referee selected by the chair of the honors committee. Referees will return the thesis to the student one week before the last day of classes. If reviewers indicate that changes must be made, the revised thesis should be submitted to the Entomology Research Honors Committee chair no later than the last day of classes. Referees should include a recommendation to the Entomology Research Honors chair regarding acceptability of the honors theses. Approved honors theses will be bound and housed in the Entomology Library in Comstock Hall.

Natural Resources

Faculty committee: J. B. Yavitt, B. A. Knuth, J. P. Lassoie, E. Mills

The research honors program in natural resources provides an opportunity for undergraduates to pursue supervised independent research in the areas of applied ecology or resource policy and management. The subject matter and nature of the research experience may be quite varied. The guidance and supervision of a faculty member with substantial interest and expertise in the subject area is essential to the success of the project.

In addition to meeting requirements of the college, the student is expected to do the following:

- Register for the research honors program in the junior year or earlier.
- Work with a faculty adviser to identify and formulate a research problem.
- If the faculty adviser is not in the Department of Natural Resources, select a co-adviser from the department to insure the research is consistent with the field.
- Carry out an independent research effort that is original and separate from the work of others who may be investigating similar subjects.
- Describe and summarize the work in the format of a conventional master's thesis or scientific paper ready for publication in a scientific or policy journal. A copy is due the first week of April. This version will be reviewed by two ad hoc reviewers, and the student will be able to incorporate their comments and suggestions into the final version which will be due the last day of classes. About half of the theses have been published.
- Give two oral presentations to the group of other honors research students and invited faculty members. Both presentations are during the student's senior year.
- Students should be aware that this requires a considerable time commitment, and they are responsible for meeting deadlines and being prepared for presentations and other meetings.

Nutritional Sciences

Faculty committee: M. N. Kazarinoff

The research honors program offers students a research experience structured to give them the opportunity to choose a research project, search the literature relevant to it, plan and execute the research, and write it up in the form of a thesis. As in other types of research available to undergraduates, each student is guided by a faculty mentor. The honors project is designed to be spread across both semesters of the junior and senior years.

Students who consider this option should be aware that it involves a number of deadlines and considerable time commitment. Before signing on for research honors, students need to consult with their academic advisers to make sure that honors will not interfere with other academic objectives, such as preparation for admission to medical school or making the dean's list. Although honors research credits for spring semester junior year and both semesters senior year are designated LET, individual mentors may choose the R grade for work in progress until the project has been fully completed. Grade is determined by each student's mentor. An outline of activities for both years is given below. Letters of invitation are sent to upcoming juniors during the summer.

Junior Year

Fall Semester Course No: NS 398 (1 credit, S-U): Students are oriented to the program, and provided material that summarizes the range of research activities in DNS. Students begin making arrangements with faculty members. When these arrangements have been completed, students begin a literature search that focuses on their research problems.

Spring Semester Students register for NS 498 (1 credit, section 1). Additional faculty

presentations of research opportunities are made, as well as orientation to supportive services available through DNS. Placements with faculty mentors should be completed by spring break. Each student may also register under the number NS 499 for a convenient number of credits, to be determined in consultation with the chosen adviser. Work carried out will have two objectives:

1. to become familiar with literature and/or research methods appropriate to the problem for the honors research,
2. to develop a research proposal.

The semester outcome will be written reports/discussions of the method(s) or literature searches and a short research proposal, evaluated by the research adviser.

Senior Year

Fall Semester Students will register under the number NS 499 (2–4 credits, LET, by arrangement with their mentors). They may begin their research earlier than fall, (e.g. during the summer, or even earlier) but should be prepared to begin research **early in the fall semester at the latest**. The objective for the semester will be to conclude most of the hands-on research/data acquisition.

Spring Semester Students will again register under course number NS 499 for 2–4 credits, LET, by arrangement with their research mentors. Much of the allotted time will be spent on analyzing data and on writing the honors thesis.

Several important deadlines should be noted.

1. **Last week in March:** The names of thesis readers* are to be in the hands of the research honors committee.
2. **Third to fourth week of April:** A final draft of the thesis is handed to the readers.
3. **First to second week of May:** Scheduled seminars for oral presentations of each student's research.
4. **Last day of classes:** Final form of the thesis is handed to the research honors chair.

To help students meet these deadlines, students register for NS 498 (1 credit, section 2) class sessions will be held before spring break for guidance in thesis writing and/or informal reporting of preliminary data. After spring break the group will meet once or twice (depending on number of students) to practice oral presentations of completed research.

*Two readers knowledgeable in the area of the student's research topic to be chosen by the research honors committee and faculty advisers.

Physical Sciences

Faculty committee: J.-Y. Parlange, chair; S. Colucci, S. J. Mulvaney, R. L. Strawderman

The research honors program in physical sciences provides outstanding students with an opportunity to do independent research under the supervision of a faculty member in the departments of Agricultural and Biological Engineering, Food Science, Earth and Atmospheric Sciences, or Biometrics.

In addition to meeting the requirements of the college, the student is expected to:

- Identify a thesis adviser and thesis topic before the end of junior year.
- Work with the thesis adviser, prepare a budget and application form (due by the sixth week of senior year).
- Enroll in the program for a minimum of two semesters.
- Enroll in the appropriate departmental undergraduate research course for a total of at least six credits.
- Submit an outline of the thesis to the chair of the committee by the end of January (for a May graduation).
- Submit a draft of the thesis to the thesis adviser with sufficient lead-time for a revision to be prepared.
- Submit three copies of the thesis and names of recommended reviewers to the chair of the honors committee by three weeks before the end of classes in the semester in which graduation is expected.

There is no required format but the thesis is usually written in the form of a research journal article or a master's thesis.

Further details of the program can be obtained from the chair of the Physical Sciences Research Honors Committee.

Plant Sciences

Faculty committee: R. L. Obendorf, chair; I. A. Merwin, E. B. Nelson, F. S. Rossi

Students perform independent scientific research under the guidance of faculty members in fields of horticultural, agronomic, and soil sciences; plant biology; plant genetics and breeding; and plant pathology. For admission to the program, students must meet college requirements and submit to the Plant Sciences Honors Committee a project proposal (two to three pages) which includes a title; a brief background to the problem (justification and literature review); a clear statement of objective(s) and hypotheses to be tested; methodology and experimental plan, necessary space, equipment and supplies; and a project budget. The proposal must be accompanied by a letter from the faculty supervisor stating that he or she has approved the project plan and that its completion within the remainder of the student's undergraduate tenure is feasible.

Successful completion of the research honors program requires acceptance by the honors committee of two copies of a research report. The report should be written in the format of a research publication in the appropriate scientific field. The acceptable report must have been reviewed and corrected according to the recommendations of the research supervisor before the report is submitted to the honors committee. The report must be received by the honors committee at least two weeks before the last day of classes of the semester in which the degree is sought and must be accompanied by a letter from the research supervisor evaluating the research and, if appropriate, recommending graduation with distinction in research.

The research honors committee will review the report within one week and may accept it or return it to the student with specific recommendations for revisions. A suitably revised version must be submitted to the committee before the second day of the examination period. When the committee accepts an honors report, the chair will recommend to the associate director of academic programs and to the college registrar that the student be graduated with distinction in research. One copy of the accepted report will be returned to the student with review comments from the committee.

Social Sciences

Faculty committee: R. E. Ostman, S. Feldman, J. M. Conrad, S. Peters

Students are accepted into the social sciences research honors program of the College of Agriculture and Life Sciences after meeting all the criteria described above, after evaluation of the student's written application, and on approval of a detailed thesis proposal. The application and proposal are due no later than the third week of the first semester of the senior year. Each student is encouraged to begin working on this proposal with a prospective faculty thesis adviser during the junior year. The purpose of the proposal is twofold. First, it formalizes a plan of study and establishes a set of expectations between the student and his or her faculty adviser. Second, the Honors Committee reviews the proposal to determine whether it is consistent with honors thesis requirements and to make suggestions for improvement.

The proposal should be 5 to 10 typed, double-spaced pages and include the following:

- **Research Topic:** State the problem to be studied or the topic of interest. Review the relevant literature and the background of the problem or topic; include a more extensive bibliography.
- **Research Questions/Empirical Hypotheses:** Specify the questions to be answered or hypotheses to be tested empirically via collection of data and a mode of analysis accepted in the social sciences.
- **Research Methods:** Discuss the models to be constructed (if any), sampling procedures, data collection procedures (including measurement instruments and survey or experimental designs, if appropriate), and methods of analysis.
- **Expected Significance:** State what new knowledge or information is likely to be forthcoming and why it is important.

Faculty advisers must be members of the graduate faculty. Exceptions to this rule will be granted for persons with special expertise who are deemed capable of thesis supervision; exceptions will be granted pending petition to the Social Science Honors Committee. Students may register for honors credit directed by the faculty adviser in conjunction with a research honors project.

Distinction in research is awarded upon approval of the research honors thesis by the social science honors committee. The research should deal with a substantive issue in one of the fields in the social sciences. Both the results of the research and the methodology (or the argument by which the results were achieved) must be reported. Reviews of the literature, practical conclusions or applications, or broad characterizations of an area of inquiry may constitute part of the research report but are not themselves sufficient to count as research.

Honors theses should be written according to the form of any standard journal within the appropriate field. Three copies of the thesis must be submitted to the chair of the social science committee no later than three weeks before the last day of classes of the semester for which the degree is sought. A supporting letter from the faculty member supervising the work also must be submitted. The thesis will be independently reviewed and revisions may be required before the thesis is presented for final approval. Final approval of the thesis requires a majority vote of the honors committee.

INTERCOLLEGE PROGRAMS

The College of Veterinary Medicine may accept students who are then permitted to double-register in their seventh and/or eighth semester and complete requirements for the Bachelor of Science degree in the College of Agriculture and Life Sciences. Students should consult with the college registrar, 140 Roberts Hall, to ensure that degree requirements have been fulfilled.

Students who have been offered admission to the S. C. Johnson Graduate School of Management may take management courses in their senior year if approved by their college faculty adviser as part of their undergraduate program. These courses count toward the endowed college credits (maximum 55 without additional tuition charge). Students may consult with the college registrar, 140 Roberts Hall, to verify degree requirements and endowed credits earned.

Students in the Engineering Program in Agricultural and Biological Engineering are usually enrolled in the College of Agriculture and Life Sciences during the freshman and sophomore years and jointly enrolled in this college and the College of Engineering in the junior and senior years. Students pay the engineering college tuition during the senior year. The B.S. degree is awarded in cooperation with the College of Engineering. The curriculum is accredited by the Accreditation Board for Engineering and Technology.

The Department of Landscape Architecture offers a first professional degree curriculum in landscape architecture at both undergraduate (BSLA) and graduate levels (MLA I), as well as a second professional graduate degree program (MLA II). The curricula for both the undergraduate and graduate programs are accredited by the Landscape Architecture Accreditation Board, LAAB. The graduate program is cosponsored by the Department of Landscape Architecture in the College of Agriculture and Life Sciences and by the College of Architecture, Art, and Planning.

The Division of Nutritional Sciences is an intercollege unit affiliated with the College of Human Ecology and the College of Agriculture and Life Sciences. The nutrition, food, and agriculture major offers students in the College of Agriculture and Life Sciences the opportunity to focus their studies in human nutrition while obtaining a strong background in courses related to agriculture and the life sciences. Students in the biological sciences major may complete the program of study in human nutrition. Courses offered by the Division of Nutritional Sciences support many undergraduate programs in the College of Agriculture and Life Sciences including animal science, biological sciences, communication, food science, international agriculture, plant sciences, and rural sociology. Nutritional sciences courses count toward the undergraduate degree requirement for 55 credit hours of courses in Agriculture and Life Sciences.

The American Indian Program (AIP) is a multidisciplinary intercollege program consisting of academic, research, extension, and student support components. Course work is intended to enhance students' understanding of the unique heritage of North American Indians and their relationship to other peoples in the United States and Canada. Students are challenged by such topics as the sovereign rights of Indian nations and the contemporary relevance of Indian attitudes toward the environment. The program's instructional core consists of courses that focus on American Indian life from pre-contact times to the present and feature the perspectives of Native American people.

Research areas among faculty active in the program include Indian education, social and economic development, agriculture, environmental issues, history, sociology, language, literature and the arts, and cultural preservation. Extension and outreach efforts within the program seek to develop solutions to problems identified by Indian communities and to facilitate the application of institutional resources, research, and expertise to community needs.

The American Indian Program's Akwe:kon Press publishes *Native Americas,* a multidisciplinary journal that covers issues across the Western Hemisphere, and sponsors conferences, guest lectures, and forums on important local, national, and international issues. Akwe:kon, the American Indian Residence House, offers undergraduate students a living environment that promotes intercultural exchange.

The American Indian Program offers a concentration in American Indian Studies to undergraduate students in conjunction with their major defined elsewhere in the university. The concentration will be earned upon completion of five courses: American Indian Studies 100 (Indian America to 1890) and American Indian Studies 175 (Contemporary American Indian Issues), plus three other courses selected from the American Indian Studies course listing, for a total of at least 15 credits. Students choosing a concentration in American Indian Studies should obtain application materials from the AIP office in 450 Caldwell.

AIP also offers a graduate minor. Students interested in choosing the minor should contact Daniel Usner, American Indian Program, (607) 255–8402.

Science of Earth Systems (SES) major emphasizes the rigorous and objective study of the Earth system as one of the outstanding intellectual challenges of modern science and as the necessary foundation for the future management of our home planet. Within this program, Cornell's strengths across a broad range of earth and environmental sciences have been brought together to provide students with the tools to engage in what will be the primary challenge of the twenty-first century.

The major is available to students in the College of Agriculture and Life Sciences as well as students in the Colleges of Arts and Sciences and, as an option, Engineering. The SES major has its home in the Department of Earth and Atmospheric Sciences, which spans all three colleges, but relies on the collaboration of several departments across the university.

The SES curriculum provides strong preparation in mathematics, physics, chemistry, and biology during the freshman and sophomore years. In the junior and senior years, students take a set of common SES core courses and an additional set of advanced disciplinary or inter-disciplinary courses that build on the basic sequences. Graduates of Cornell's SES program are well prepared for graduate studies in the earth and environmental sciences. The SES major also provides an excellent background for students wishing to pursue careers, with or without advanced study, in environmental law and policy, and environmental protection. SES is also a good major for students wishing to teach earth and environmental science at the high school level, perhaps in conjunction with Cornell's Teacher Education in Agriculture, Mathematics, and Science (TEAMS) program.

See the Science of Earth Systems listing in the section on "Major Fields of Study" for complete information about the SES curriculum. For more information contact Professor Kerry H. Cook, Department of Earth and Atmospheric Sciences, khc6@cornell.edu, and visit the web site: www.geo.cornell.edu/ses/

The Comparative and Environmental Toxicology Program is an interdisciplinary intercollege program with research, teaching, and cooperative extension components coordinated by the Institute for Comparative and Environmental Toxicology (ICET). Courses are cosponsored by academic departments in several colleges of the university. A description of the program and general information is available from the director of the program through the ICET office, 213 Rice Hall, or at www.cfe.cornell.edu/icet. See also the Interdisciplinary Centers, Programs, and Studies section at the front of this catalog.

The Cornell Institute for Resource Information Systems (Cornell IRIS) is an interdisciplinary, inter-college unit affiliated with the Center for the Environment. The mission of Cornell IRIS is to advance the development and use of spectral and spatial information science and technology to benefit the environment. The Institute is comprised of three program areas in environmental resource inventory, remote sensing, and geographic information systems. A description of these programs and general information is available from the Institute director through the Cornell IRIS office in 302 Rice Hall.

OFF-CAMPUS STUDY PROGRAMS

Study off campus is of two types: (1) credit may be earned at another institution and transferred to Cornell, or (2) credit may be earned in Cornell courses that require off-campus activity.

Students who plan to enroll in courses at another institution in the United States must petition for a leave of absence. Courses

should be selected in consultation with the faculty adviser.

Albany Programs

Study off campus in Albany, the New York State capital, provides a unique opportunity to combine career interests with academic and legislative concerns. Three formalized opportunities are available. The Assembly Intern Program is offered in the spring semester and provides placement with a staff member of the New York State Assembly. The Senate Assistants Program also occurs during the spring semester and has placements with New York State senators and selected staff. The Albany Semester Program is available during the spring, summer, and fall semesters and provides experience with a state agency such as the Departments of Environmental Conservation, Education, or Labor. Each program has an academic component as well. Check the individual folders in the internship files in the ALS Career Development Office, 177 Roberts Hall.

Applications are collected and processed by the ALS Career Development Office, 177 Roberts Hall, in the term prior to assignments. Those accepted should plan a program of study in consultation with their faculty adviser. At least 12 credits must be carried to meet the residency requirement. To receive academic credit for the internship, students enroll in ALS 400, for an S-U grade only.

Information and applications are available in the ALS Career Development Office, 177 Roberts Hall.

Cornell-in-Washington

The Cornell-in-Washington Program offers students from all colleges in the university an opportunity to earn full academic credit for a semester in Washington, D.C. Students take courses from Cornell faculty, conduct individual research projects, and work as externs. The Cornell-in-Washington Program offers two study options: (1) studies in public policy, and (2) studies in the American experience. Students take part in a public policy or humanities seminar which requires them to serve as externs in federal agencies, congressional offices, or nongovernmental organizations and to carry out individual research projects under the supervision of Cornell faculty. The required externships and all course enrollments are arranged through, and approved by, the Cornell-in-Washington Program. Students in the College of Agriculture and Life Sciences must register for ALS 500 and cannot receive credit for the externship experience alone. For further information, see p. 21, inquire at 311 Caldwell Hall, 255–4090, or visit the Cornell-in-Washington web site at ciw.cornell.edu.

SEA Semester

The Sea Education Association is a nonprofit educational institution offering ocean-focused academic programs and the opportunity to live, work, and study at sea. Science, the humanities, and practical seamanship are integrated in small, personal classes. The 17-credit program is 12 weeks in length. Six weeks are spent in Woods Hole, and the following six weeks are spent on either one of SEA's two sailing vessels: the R/V Westward or the R/V Corwith Cramer. For more information, students should contact the Cornell Marine Programs office, G14 Stimson Hall (607–255–3717) or visit SEA's web site: www.sea.edu. ALS students should file an intent to study off campus form with the college registrar as early as possible to ensure proper registration and enrollment in courses.

Shoals Marine Laboratory

The Shoals Marine Laboratory, run cooperatively by Cornell University and the University of New Hampshire, is a seasonal field station located on the 95-acre Appledore Island off the coast of Portsmouth, New Hampshire, in the Gulf of Maine. SML offers undergraduates and other interested adults a unique opportunity to study marine science in a setting noted for its biota, geology, and history. Please refer to "Courses in Marine Science," under the section on the Office of Undergraduate Biology, for a list of courses offered.

For more information, contact the Shoals Marine Laboratory office, G14 Stimson Hall, 607–255–3717 or visit their web site: www.sml.cornell.edu.

Internships

Several departments in the college offer supervised internships for academic credit. Arrangements should be made with the offering department for assignment of a faculty member who will be responsible for planning the program of work and for evaluating student performance.

For internships not governed by an established internship course, the student must enroll in a 497 course for the number of credits to be assigned. If the work is done during the summer, the student must enroll in the Cornell summer session for the agreed-upon credits.

In cases where the work is not done at Cornell, the awarding of credits depends upon a prior contractual arrangement between a Cornell professor and the student. Specific terms for receiving credit and a grade should be recorded, using the Independent Study, Research, Teaching, or Internship form, available in the Registrar's Office, 140 Roberts Hall.

A maximum of 15 (pro-rated for transfer students) of the 120 credits required for the degree may be taken in internships, independent study courses, and undergraduate teaching or research. No more than 6 of the 15 credits allowed for independent study may be awarded for internships consisting of off-campus work experiences that do not have the continued presence of a Cornell faculty member. The six-credit allotment includes transfer credit and credit for internships in other colleges at Cornell. The six-credit limit does not apply to secondary, postsecondary, and cooperative extension teaching internships in the Department of Education.

The College of Agriculture and Life Sciences does not offer a field study option. In general, a rather narrow view is taken toward awarding academic credit for work experience, "life" experience, or apprenticeships. Credit will only be assigned or accepted in cases where a professor is directly involved in determining both the course content and in evaluating a student's work. The awarding of credit will not be allowed in cases where a student brings to the college or to a professor a description of a past experience and requests credit. All students enrolling for an internship must file an Independent Study, Research, Teaching, or Internship form with the Office of the College Registrar.

International Exchange Programs in The College of Agriculture and Life Sciences

Any student whose grade point average is 2.75 or above and has completed one year of continuous study in CALS may apply to a CALS international student exchange programs.

These undergraduate exchange opportunities are for **CALS students only**. For more information on programs and application process, see the CALS Study Abroad Adviser in 140 Roberts Hall or visit our web site www.cals/oap/advising/international/index.cfm.

Students who are interested in international study but not in one of the CALS programs must apply through **Cornell Abroad** in 474 Uris Hall. Please refer to the Cornell Abroad section of *Courses of Study*.

MAJOR FIELDS OF STUDY

The college curriculum consists of 20 major program areas that reflect the departmental academic effort in the college. Faculty curriculum committees in each area identify a sequence of courses appropriate to all students studying in that field. Courses of study are designed to provide systematic development of basic skills and concepts. Opportunity for concentration in an area of particular interest is usually available.

Programs are planned with considerable flexibility, allowing students to prepare for careers, graduate work, professional opportunities, and the responsibilities of educated citizens. Course requirements in each program area are different, but all students must meet the minimum distribution requirements of the college.

Agricultural and Biological Engineering

The Department of Agricultural and Biological Engineering addresses three great challenges facing humanity today: ensuring an adequate and safe food supply in an era of expanding world population; protecting and remediating the world's natural resources, including water, soil, air, biodiversity, and energy; and developing engineering systems that monitor, replace, or intervene in the mechanisms of living organisms. The undergraduate engineering program in the Department of Agricultural and Biological Engineering has a unique focus on biological systems, including the environment, that is realized through a combination of fundamental engineering sciences, biology, applications courses, and liberal studies. The program leads to a Bachelor of Science degree, which is awarded jointly by the Colleges of Engineering and Agriculture and Life Sciences, and is accredited by the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET).

Two concentrations in Agricultural and Biological Engineering are offered: biological engineering and environmental engineering. Students take courses in mathematics, statistics, computing, physics, chemistry, basic and advanced biology, fundamental engineering sciences (mechanics, thermodynamics,

fluid mechanics, and transport processes), engineering applications, and design. Students select upper-level courses in the department in areas that include bioprocessing, soil and water management, bioenvironmental and facilities engineering, bioinstrumentation, engineering aspects of animal physiology, environmental systems analysis, and waste treatment and disposal. Students select other courses in the College of Engineering that strengthen their program, such as environmental engineering or biomedical engineering. Students planning for medical school also take additional lab-based courses in biology and organic chemistry. Throughout the curriculum, emphasis is placed on communications and teamwork skills. Students in the engineering program may pursue minors and options in specialized areas as noted in the engineering section of this publication. **Specific course requirements and other information for the Agricultural and Biological Engineering joint program are in the College of Engineering section of this publication.** Further information is available at the undergraduate program office, ABEN Student Services, 207 Riley-Robb.

The department also offers two technology programs: Biological Systems Technology and Environmental Systems Technology. The technology programs emphasize applied and technical aspects of biological, environmental, and agricultural sciences. These programs incorporate courses in basic biological and physical sciences and mathematics as well as engineering and technology, agriculture, business, social sciences, and liberal studies. The department also participates in the interdisciplinary major, Science of Earth Systems (SES). Students in the joint engineering program may minor in SES by taking 18 credits of engineering and science electives as part of their engineering program. Students in the technology program may participate in SES by completing the SES courses as part of their technology program. Students may pursue the SES major through any one of the cooperating departments as noted in the SES description on page 53. The student develops his or her own program of advanced and elective courses in consultation with a faculty adviser, and may minor in an area such as communication, business, education, or international agriculture.

Many undergraduate students participate in teaching assistantships, research assistantships, design teams, and study abroad. Students in the Engineering program are also eligible to do Engineering Co-Op. Students should have a strong aptitude for the sciences and mathematics and an interest in the complex social issues that surround technology.

Career opportunities cover the spectrum of private industry, public agencies, educational institutions, and graduate programs in engineering, science, medicine, law, and other fields. In recent years graduates have developed careers in environmental consulting, biotechnology, the pharmaceutical industry, biomedical engineering, management consulting, and international development.

The living world is all around us and within us. The biological revolution continues and it has given rise to a growing demand for engineers who have studied biology and the environment, who have strong math and science skills, who can communicate effectively, who are sensitive to the needs of people, and who are interested in the challenges facing society. The Department of Agricultural and Biological Engineering is educating the next generation of engineers to meet these challenges.

Specific course requirements for the Accredited Engineering Programs are found in the College of Engineering section of this book.

Specific course distribution requirements for the academic programs in Biological Systems Technology and Environmental Systems Technology include

		Credits
A.	*Basic Subjects*	
1.	Calculus	8
2.	Chemistry	6
3.	Physics	8
4.	Introductory biological sciences	6
5.	Computer programming	4
6.	Statistics or probability	3
7.	Written and oral expression	9
B.	*Advanced and Applied Subjects*	
1.	Five courses in the biological, environmental, or agricultural sciences	15
2.	Five engineering or technology courses at the 300 level or above; at least 9 credits in agricultural and biological engineering	15
C.	*Electives*	
	Additional courses to complete college requirements	
D.	*Total (minimum)*	*120*

For further details on the Agricultural and Biological Engineering and Technology Programs (including SES), see the department's Undergraduate Programs brochure, available at 207 Riley-Robb Hall; contact the advising coordinator, Professor Jim Bartsch, at 255–2800; or visit the department's web site at www.aben.cornell.edu.

Animal Sciences

The animal sciences program area offers a coordinated group of courses dealing with the principles of animal breeding, nutrition, physiology, management, and growth biology. Emphasis in subject matter is directed toward domestic animal species, dairy and beef cattle, horses, poultry, pigs, and sheep, while laboratory, companion, and exotic animal species are also included in research and teaching programs. The Animal Science Department has extensive facilities for animal production and well-equipped laboratories and classrooms, including a teaching barn, in which students can gain practical experience in the care and management of large animals.

The program focuses on the application of science to the efficient production of animals for food, fiber, and pleasure and easily accommodates a variety of interests and goals. Beyond a core of basic courses (suggested minimum, 15 credits) students select production and advanced courses to fulfill an individually tailored program worked out in consultation with their advisers. In this way it is possible to concentrate by species as well as by subject matter (nutrition, physiology, growth biology, breeding, management). For each subject area, supporting courses in other departments are readily available and strongly encouraged. Many science-oriented students elect a program emphasizing supportive preparation in the physical and biological sciences appropriate to graduate, veterinary, or professional study following graduation. Dairy management is a popular program among students who may be preparing to manage a dairy farm or enter a related career. Other students may elect a program oriented toward economics and business in preparation for a career in the poultry, dairy, meat-animal, horse, feed, or meats industry. These are examples of the flexibility within these programs that can be developed to meet a student's career interest related to animals.

It is recommended that students obtain appropriate fieldwork or animal experience during summers. Several special training opportunities exist for highly motivated students. Juniors and seniors whose academic records warrant it may, by arrangement with individual faculty members, engage in research (either for credit or Honors) or assist with teaching (for credit). The Dairy Management Fellows Program offers an equally challenging but different type of experience for a highly select group of students.

Applied Economics and Management

The undergraduate program in the Department of Applied Economics and Management (AEM) offers programs of study in three broad areas: Business, Agribusiness, and Applied Economics. Here you will find what will soon be only the second accredited undergraduate general business program in the Ivy League, as well as specializations focusing on the economics of agriculture and the environment.

Applied Economics and Management courses stress the application of analytical skills, critical thinking, and economic theory to real-world business and public-policy issues. Six areas of specialization are offered:

Business, one of the largest undergraduate majors at Cornell University, offers students a variety of courses that provide not only breadth, but also depth in most business fields, including finance, marketing, entrepreneurship, and general management.

Food industry management is designed for students interested in management positions with the processing, manufacturing, or distributions segments of the food industry, an industry that accounts for $1 out of every $3 in retail sales in the U.S.

Agribusiness management students study general business courses, including business management, marketing, accounting, and finance, as well as courses tailored to agricultural businesses.

Farm business management and finance, an agribusiness specialization, is designed for students interested in working for firms with ties to farming and agriculture, such as cooperatives, commercial banks, horticultural businesses, family farms, Farm Credit Services, and agribusiness firms.

Agricultural and applied economics is a broad-based specialization that focuses on such important national and international issues as the economics of policy, markets, production, international trade, and international development.

Environmental and resource economics is designed for students interested in the economics of such international issues as

water and air quality, waste management, rural-urban land use, the sustainability of natural resources, energy use, and global climate change.

AEM graduates are actively recruited by elite businesses for positions in finance, marketing, investment banking, and management consulting, as well as by federal and international agencies. Many graduates go on for advanced professional and academic degrees, often after several years in a challenging career position in business or government.

Atmospheric Science

Atmospheric Science is the study of the atmosphere and the processes that shape weather and climate. The curriculum emphasizes the scientific study of the behavior of weather and climate, and applications to the important practical problems of weather forecasting and climate prediction. Students develop a fundamental understanding of atmospheric processes and acquire skill and experience in the analysis, interpretation, and forecasting of meteorological events. All students are required to complete a minimum of three semesters of calculus, two semesters of physics, and a semester each of chemistry, computer science, and statistics.

Atmospheric science courses are offered through the Department of Earth and Atmospheric Sciences (EAS). There are two options for the B.S. in Atmospheric Science through the College of Agriculture and Life Sciences:

Option A

1. Mathematics, Computer Science, and Statistics:
   a. Math 190/191, 192, 293; or Math 111, 112, 213
   b. Computer Sci. 100, or EAS 150
   c. AEM (ARME) 210 or equivalent
   d. Math 294 (or MATH 221 and 222, without MATH 213) or EAS 435
2. Basic Physical Sciences:
   a. Physics 207, 208, or Physics 112, 213, 214
   b. Chem 103, 207, or 211
3. Atmospheric Science:
   a. EAS 131, 250, 341, 342, 352, 447, 451
   b. At least two atmospheric science electives

Option B

1. Mathematics, Computer Science, and Statistics:
   a. Math 190/191, 192, 293, 294; or Math 111, 112, 221, 222
   b. Computer Sci. 100, or EAS 150
   c. AEM (ARME) 210 or equivalent
   d. Math 321, Math 420, or T&AM 310
2. Basic Physical Sciences:
   a. Physics 112, 213, 214
   b. Chem 207 or 211
3. Atmospheric Science:
   a. EAS 341, 342, 352, 451

Option A is intended to meet the needs of students whose primary interests are in forecasting and operational meteorology. Upon graduation, a student who has completed Option A will have satisfied both the curricular guidelines of the American Meteorological Society and the educational requirements of the National Weather Service for employment as a meteorologist. They will also be well qualified for positions in private-sector forecasting, environmental consulting firms, and in broadcast meteorology. In addition, Option A provides good preparation for graduate work in atmospheric science and closely related fields.

Option B is designed to focus on preparation for graduate study in atmospheric as well as other sciences, and includes somewhat stronger coursework in mathematics and physics than does Option A. The minimum coursework in Option B does not satisfy the National Weather Service requirements or American Meteorological Society guidelines for employment in operational meteorology, but may be more appropriate for students with academic or research career goals. It can also be an attractive option for students transferring into the program as juniors.

Biological Sciences

Biology is a popular subject at many universities for a variety of reasons: it is a science that is in an exciting phase of development; it prepares students for careers in challenging and appealing fields such as human and veterinary medicine, environmental sciences, and biotechnology; and it deals with the inherently interesting questions that arise when we try to understand ourselves and the living world around us. Many of the decisions we face today deal with the opportunities and problems that biology has put before us.

The major in biological sciences is available to students enrolled in either the College of Agriculture and Life Sciences or the College of Arts and Sciences. The Office of Undergraduate Biology provides student services which are available to students from either college.

The biology major is designed to enable students to acquire the foundations in physical and life sciences necessary to understand modern biology and to pursue advanced studies in a specific area of biology. Programs of study include either general biology or one of the following concentrations: animal physiology, biochemistry, computational biology, ecology and evolutionary biology, genetics and development, molecular and cell biology, microbiology, neurobiology and behavior, nutrition, plant biology, and systematics and biotic diversity. Students interested in the marine sciences should consult the Shoals Marine Laboratory Office, G14 Stimson Hall, 255–3717, for academic advice and career counseling. For more details about the biology curriculum see the section in this catalog on Biological Sciences.

Biology & Society

The Biology & Society program area is designed for students who wish to combine the study of biology with exposure to perspectives from the social sciences and humanities. Many of the most critical social issues of our time, from the implications of genetic engineering to the impact of global climate change, have biological processes at their core. At the same time these issues are inherently social, involving complex relationships among people, institutions, laws, and beliefs. The Biology & Society field of study provides the skills and perspectives necessary to confront problems with biological, social, and ethical dimensions. In consultation with a faculty member, students are expected to select their courses in the field to meet their own goals and interests. For a description of the Biology & Society requirements and courses, see the section on Biology and Society under "Special Programs and Interdisciplinary Study" in this publication or visit the web site at www.sts.cornell.edu.

Students who elect Biology & Society as their major field of study leave Cornell with well-developed writing and analytical skills and a knowledge base that can lead to employment in a variety of fields. Many graduates have accepted positions as health counselors, writers, or policy analysts and researchers for government organizations, medical institutions, consumer or environmental groups, or scientific research institutes. Students have found that Biology & Society is also excellent preparation for professional training in medicine, law, and health services administration and for graduate programs in such fields as genetic counseling, nutrition, clinical psychology, public health, environmental studies, anthropology, sociology, and other related fields.

Admissions

Students must have completed a year of college-level biology and must submit an application during their sophomore year. Students in the College of Agricultural and Life Sciences may be admitted directly into the field of study when they apply to the college; as with all students admitted prior to completing the biology prerequisite, the admission is provisional. It is the student's responsibility to assure that final acceptance is granted upon completion of the introductory biology sequence. Although only introductory biology is a prerequisite for acceptance, students will find it useful to have completed some of the other requirements (obtain course checklist in 275 Clark Hall) by the end of their sophomore year. Juniors are considered on a case-by-case basis. Upper-division applicants should realize the difficulties of completing the biology and society requirements in less than two years.

The application includes:

- A one- to two-page statement explaining your intellectual interests in Biology & Society and why it is consistent with your academic goals and interests.
- A selected theme.
- A tentative plan of courses fulfilling Biology & Society requirements, including courses you have taken and those you plan to take.
- A transcript of work taken at Cornell University, current as of the date of application.

The faculty admissions committee reviews applications twice a year, once each during the fall and spring semesters. A faculty adviser is assigned on admittance to the field. Approximately 50 faculty members from five colleges serve as advisers to Biology & Society students. The major program is coordinated for students in all colleges through the Biology and Society Office, 275 Clark Hall, where students can get information, specific

course requirements, and application forms. Faculty and student advisers are available to discuss the Biology & Society requirements with you.

Requirements for the program are listed below. A full description and listings of courses that satisfy the requirements can be obtained in 275 Clark Hall or on the web at www.sts.cornell.edu. Also refer to the section on Biology & Society under "Special Programs and Interdisciplinary Study" in this publication.

Biology and Society Requirements:

- Introductory biology (101–104, 105–106, or 107–108)
- College calculus (one course)
- Ethics (one course)
- Two social sciences/humanities foundation courses
- Three biology foundation courses
- One biology depth course
- Statistics (one course)
- Core course
- Five theme courses (a coherent group of five courses relevant to the student's special interest in Biology & Society, including a senior seminar that serves as a capstone course for the program).

Students should develop their theme and select their courses in consultation with a member of the Biology & Society faculty. A list of faculty is available in 275 Clark Hall. Further information may be obtained by calling (607) 255–6047 or sending an e-mail message to msw8@cornell.edu.

I. First-Year Writing Seminars

Check the current FWS pamphlet for information.

II. Foundation Courses

A. Ethics (select one)

B&SOC 205 Ethical Issues in Health and Medicine (also S&TS 205)
Fall. 4 credits. Limited to 150 students. E. Toon.
For description, see B&SOC 205.

B&SOC 206 Ethics and the Environment (also S&TS 206 and PHIL 246)
Spring. 4 credits. Limited to 60 students. N. Sethi.
For description, see B&SOC 206.

B. Social Sciences/Humanities Foundation (2 courses, 1 from any 2 areas)

1. History of Science

[S&TS 233 Agriculture, History, and Society: From Squanto to Biotechnology
Fall. 3 credits. Not offered 2001–2002. M. Rossiter.
For description, see S&TS 233.]

S&TS 282 Science in Western Civilization (also HIST 282) #
Spring. 4 credits. P. Dear.
For description, see HIST 282.

[S&TS 283 The Sciences in the Twentieth Century (also HIST 280)
Spring. 4 credits. Not offered 2001–2002. M. Dennis.
For description, see S&TS 283.]

S&TS 287 Evolution (also BIOEE 207 and HIST 287)
Fall or summer. 3 credits. W. Provine.
For description, see BIOEE 207.

S&TS 355 Computers: From Babbage to Gates
Fall. 4 credits. M. Dennis.
For description, see S&TS 355.

[S&TS 390 Science in the American Polity: 1800–1960 (also GOVT 308, AM ST 388)
Fall. 4 credits. Not offered 2001–2002. M. Dennis.
For description, see S&TS 390.]

[S&TS 433 Comparative History of Science
Spring. 4 credits. Not offered 2001–2002. M. Rossiter.
For description, see S&TS 433.]

S&TS 444 Historical Issues of Gender and Science (also WOMNS 444)
Spring. 4 credits. M. Rossiter.
For description, see S&TS 444.

2. Philosophy of Science

S&TS 201 What is Science? An Introduction to the Social Studies of Science and Technology
Spring. 3 credits. T. Pinch.
For description, see S&TS 201.

S&TS 286 Science and Human Nature (also PHIL 286)
Spring. 4 credits. May be used to meet the philosophy of science requirement *if not* used to meet the core course requirement. R. Boyd.
For description, see PHIL 286.

S&TS 381 Philosophy of Science: Knowledge and Objectivity (also PHIL 381)
Fall. 4 credits. Limited to 30 students. R. Boyd.
For description, see PHIL 381.

3. Sociology of Science

B&SOC 301 Biology and Society: The Social Construction of Life (also S&TS 401)
Fall. 4 credits. Limited to 75 students. May be used to meet the sociology of science requirement if not used to meet the core course requirement. E. Toon.
For description and prerequisites, see B&SOC 301.

B&SOC 342 Sociology of Science (also S&TS 442, CRP 442 and SOC 442)
Fall. 4 credits. H. Mialet.
For description, see S&TS 442.

R SOC 208 Technology and Society
Fall. 3 credits. C. Geisler.
For description, see R SOC 208.

S&TS 201 What Is Science? An Introduction to the Social Studies of Science and Technology (also SOC 210)
Spring. 3 credits. T. Pinch.
For description, see S&TS 201.

S&TS 311 The Sociology of Medicine
Spring. 4 credits. E. Toon.
For description, see S&TS 311.

S&TS 411 Knowledge, Technology, and Property
Spring. 4 credits. S. Hilgartner.
For description, see S&TS 411.

[SOC 434 The Sociology of Reproduction (also WOMNS 435)
Spring. 4 credits. Not offered 2001–2002. Staff.
For description, see SOC 434.]

4. Politics of Science

B&SOC 406 Biotechnology and the Law (also S&TS 406)
Spring. 4 credits. L. Palmer.
For description, see S&TS 406.

[B&SOC 407 Law, Science, and Public Values (also GOVT 407 and S&TS 407)
Spring. 4 credits. Not offered 2001–2002. M. Lynch.
For description, see S&TS 407.]

CRP 380 Environmental Politics
Fall. 4 credits. R. Booth.
For description, see CRP 380.

S&TS 324 Environment and Society (also R SOC 324 and SOC 324)
Spring. 3 credits. L. Glenna.
For description, see R SOC 324.

S&TS 391 Science in the American Polity: 1960–Now (also GOVT 309 and AM ST 389)
Fall. 4 credits. M. Dennis.
For description, see S&TS 391.

[S&TS 427 Politics of Environmental Protection in America (also GOVT 427)
Fall. Not offered 2001–2002. 4 credits.
For description, see S&TS 427.]

5. Science Communication

COMM 260 Scientific Writing for Public Information
Fall or spring. 3 credits. Limited to 25 non-freshman or graduate students per section.
For description and prerequisites, see COMM 260.

[COMM 421 Communication and the Environment
Spring. 3 credits. May be used in the foundation only if **not** taken as a senior seminar. Not offered 2001–2002. J. Shannahan.
For description, see COMM 421.]

S&TS 285 Communication in the Life Sciences (also COMM 285)
Spring. 3 credits. Staff.
For description, see COMM 285.

S&TS 352 Science Writing for the Mass Media (also COMM 352)
Fall. 3 credits. Not open to freshmen. Limited to 25 students. B. Lewenstein.
For description and prerequisites, see COMM 352.

[S&TS 466 Communication of Science and Technology (also COMM 466)
Fall. 3 credits. May be used in the foundation only if **not** taken as a senior seminar. Limited to 15 students. Offered even fall semesters. Not offered 2001–2002. B. Lewenstein.
For description and prerequisites, see COMM 466.]

C. Biology Foundation (breadth requirement): Three courses: one from three of the following subject areas:

1. Biochemistry, Molecular and Cell Biology

BIOBM 330 Principles of Biochemistry, Individual Instruction
Fall or spring. 4 credits. J. Blankenship, P. Hinkle, staff.
For description and prerequisites, see BIOBM 330.

BIOBM 331 Principles of Biochemistry: Proteins and Metabolism
Fall. 3 credits. May not be taken for credit after BIOBM 330 or 333. G. Feigenson.
For description and prerequisites, see BIOBM 331.

BIOBM 333 Principles of Biochemistry, Lectures
Summer. 4 credits. H. T. Nivison.
For description and prerequisites, see BIOBM 333.

NS 262 The Cell and the External World
Spring. 3 credits. N. Noy.
For description and prerequisites, see NS 262.

NS 320 Introduction to Human Biochemistry
Fall. 4 credits. W. Arion and P. Stover.
For description and prerequisites, see NS 320.

2. Ecology

BIOEE 261 Ecology and the Environment
Fall or summer. 4 credits. Not open to freshmen. N. G. Hairston.
For description and prerequisites, see BIOEE 261.

3. Genetics and Development

BIOGD 281 Genetics
Fall, spring, or summer. 5 credits. Not open to freshmen fall semester. Limited to 200 students. P. Bruns.
For description and prerequisites, see BIOGD 281.

BIOGD 282 Human Genetics
Spring. 3 credits (2 cr. if taken after BIOGD 281). Limited to 25 per discussion group. M. L. Goldberg.
For description and prerequisites, see BIOGD 282.

4. Evolutionary Biology

BIOEE 278 Evolutionary Biology
Fall or spring. 3 or 4 credits. Limited to 300 students. M. A. Geber.
For description, see BIOEE 278.

5. Microbiology

BIOMI 290 General Microbiology Lectures
Fall, spring, or summer. 2 or 3 credits (2 credits if taken after BIOMI 192). S. Merkel, S. Winans, J. Helmann.
For description and prerequisites, see BIOMI 290.

6. Neurobiology and Behavior

BIONB 221 Neurobiology and Behavior I: Introduction to Behavior
Fall. 3, 4, or 5 credits. Not open to freshmen. P. Sherman.
For description and prerequisites, see BIONB 221.

BIONB 222 Neurobiology and Behavior II: Introduction to Neurobiology
Spring. 3 or 4 credits. Not open to freshmen. Each discussion limited to 20 students. A. Bass.
For description and prerequisites, see BIONB 222.

7. Botany

BIOPL 241 Introductory Botany
Fall. 3 credits. K. J. Niklas.
For description, see BIOPL 241.

8. Physiology and Anatomy

BIOAP 311 Introductory Animal Physiology, Lectures (also VETMED 346)
Fall. 3 credits. E. Loew and staff.
For description and prerequisites, see BIOAP 311.

NS 341 Human Anatomy and Physiology
Spring. 4 credits. Permission only. Must preregister for lab in 309 MVR during CoursEnroll. V. Utermohlen.
For description and prerequisites, see NS 341.

D. Biology Foundation (depth requirement): one course for which one of the above breadth requirement courses (2C) is a prerequisite.

E. Statistics (select one)

AEM (ARME) 210 Introductory Statistics
Fall. 4 credits. C. van Es.
For description and prerequisites, see AEM (ARME) 210.

BTRY 261 Statistical Methods I
Fall or summer. 4 credits. Note: BTRY 261 is limited to undergraduates. R. Lloyd.
For description and prerequisites, see BTRY 261/601.

CRP 223 Introduction to Statistical Reasoning for Urban and Regional Analysis
Fall. 3 credits. J. Lobo.
For description, see CRP 223.

ECON 319 Introduction to Statistics and Probability
Fall. 4 credits. Y. Hong.
For description and prerequisites, see ECON 319.

ILRST 210 Statistical Reasoning I
Fall, spring. 3 credits. Staff.
For description, see ILRST 210.

MATH 171 Statistical Theory and Application in the Real World
Fall, spring. 4 credits. Staff.
For description and prerequisites, see MATH 171.

PAM 210 Introduction to Statistics
Spring. 4 credits. K. Joyner.
For description, see PAM 210.

PSYCH 350 Statistics and Research Design
Fall. 4 credits. T. Gilovich.
For description, see PSYCH 350.

SOC 301 Evaluating Statistical Evidence (also R SOC 302)
Fall. 3 credits. Staff.
For description, see SOC 301.

III. Core Courses

B&SOC 301 Biology and Society: The Social Construction of Life (also S&TS 401)
Fall. 4 credits. Limited to 75 students. E. Toon.
For description and prerequisites, see B&SOC 301.

S&TS 286 Science and Human Nature (also PHIL 286)
Spring. 4 credits. R. Boyd and N. Sturgeon.
For description, see PHIL 286.

IV. Themes

A. Natural Sciences Issues/Biology Elective (two courses). Select from the following list of B&SOC approved Natural Science Issues courses or choose course(s) with introductory biology as a prerequisite.

[B&SOC 214 Biological Basis of Sex Differences (also BIOAP 214 and WOMNS 214)
Spring. 3 credits. Not offered 2001–2002; next offered spring 2003. J. Fortune.
For description, see BIOAP 214.]

[B&SOC 347 Human Growth and Development: Biological and Behavioral Interactions (also HD 347 and NS 347)
Spring. 3 credits. Offered alternate years. Not offered 2001–2002. J. Haas and S. Robertson.
For description and prerequisites, see HD 347.]

[BIOEE 275 Human Biology and Evolution (also ANTHR 275 and NS 275)
Fall. 3 credits. Not offered 2001–2002. K. A. R. Kennedy and J. D. Haas.
For description, see BIOEE 275.]

[BIOEE 474 Laboratory and Field Methods in Human Biology (also ANTHR 474)
Spring. 5 credits. Not offered 2001–2002. K. A. R. Kennedy.
For description, see BIOEE 474.]

[BIOEE 673 Human Evolution: Concepts, History, and Theory (also ANTHR 673)
Fall. 3 credits. Offered alternate years. Not offered 2001–2002. K. A. R. Kennedy.
For description, see BIOEE 673.]

BIOPL 247 Ethnobiology
Fall. 3 credits. D. M. Bates.
For description, see BIOPL 247.

HD 266 Emotional Functions of the Brain
Fall. 3 credits. R. DePue.
For description, see HD 266.

HD 344 Infant Behavior and Development
Fall. 3 credits. Not open to freshmen. S. Robertson.
For description and prerequisites, see HD 344.

HD 370 Adult Experimental Psychopathology
Spring. 3 credits. Limited to sophomores, juniors, and seniors. S. Bem.
For description and prerequisites, see HD 370.

HD 436 Language Development (also LING 436, PSYCH 436, and COGST 436)
Spring. 4 credits. B. Lust.
For description, see HD 436.

NS 222 Maternal and Child Nutrition
Fall. 3 credits. Limited to 20. C. Garza.
For description and prerequisites, see NS 222.

NS 331 Physiological and Biochemical Bases of Human Nutrition
Spring. 4 credits. May be used to fulfill the Biology Depth requirement. M. Stipanuk.
For description and prerequisites, see NS 331.

NS 361 Biology of Normal and Abnormal Behavior (also PSYCH 361)
Fall. 3 credits. Limited to juniors and seniors only. B. J. Strupp.
For description and prerequisites, see NS 361.

NS 452 Molecular Epidemiology and Dietary Markers of Chronic Disease
Spring. 3 credits. P. Cassano.
For description and prerequisites, see NS 452.

NS 475 Molecular Nutrition and Development
Spring. 3 credits. P. Stover and D. Noden.
For description and prerequisites, see NS 475.

NTRES 201 Environmental Conservation
Spring. 3 credits. T. Fahey.
For description, see NTRES 201.

PSYCH 326 Evolution of Human Behavior
Fall. 4 credits. R. E. Johnston.
For description and prerequisites, see PSYCH 326.

Examples of biology electives

AN SCI 300 Animal Reproduction and Development
Spring. 3 credits.
For description, see AN SCI 300.

HD 366 Psychobiology of Temperament and Personality
Spring. 3 credits. P. DePue.
For description, see HD 366.

NS 331 Physiological and Biochemical Bases of Human Nutrition
Spring. 4 credits. M. Stipanuk.
For description and prerequisites, see NS 331.

B. Humanities/Social Sciences Elective (two courses)

Courses listed earlier as social science/humanities foundation courses (2.B) are particularly appropriate as social science/humanities electives. A single course, however, cannot be used to meet both requirements. Additional courses that are recommended as social science or humanities electives are:

Examples of humanities/social sciences electives

AEM (ARME) 464 Economics of Agricultural Development
Spring. 3 credits. R. Christy.
For description, see AEM (ARME) 464.

[ANTHR 211 Nature and Culture @
Spring. 3 credits. Not offered 2001–2002. Staff.
For description, see ANTHR 211.]

CRP 380 Environmental Politics
Fall or spring. 4 credits. R. Booth.
For description, see CRP 380.

HD 251 Social Gerontology
Spring. 3 credits. D. Dempster-McLain.
For description, see HD 251.

NS 245 Social Science Perspectives on Food and Nutrition
Fall. 3 credits. J. Sobal.
For description, see NS 245.

NS 450 Public Health Nutrition
Spring. 3 credits. D. Pelletier.
For description, see NS 450.

NTRES 400 International Environmental Issues
Spring. 4 credits. R. McNeil.
For description, see NTRES 400.

NTRES 407 Religion, Ethics, and the Environment
Fall. 4 credits. R. Baer.
For description, see NTRES 407.

PAM 303 Ecology and Epidemiology of Health
Spring. 3 credits. E. Rodriguez.
For description, see PAM 303.

[PAM 380 Human Sexuality
Spring. 3 credits. Not offered 2001–2002. A. Parrot.
For description, see PAM 380.]

PAM 435 U.S. Health Care Systems
Fall. 3 credits. R. Battistella.
For description, see PAM 435.

PHIL 241 Ethics (by petition for breadth requirement)
Spring. 4 credits. N. Sturgeon.
For description, see PHIL 241.

[PHIL 368 Global Climate and Global Justice (also GOVT 468)
Fall. 4 credits. Not offered 2001–2002. Staff.
For description, see PHIL 368.]

R SOC 205 International Development (also SOC 206)
Spring. 3 credits. C. Geisler.
For description, see R SOC 205.

R SOC 220 Sociology of Health of Latinos and Ethnic Minorities (also LSP 220)
Fall. 3 credits. R. Parra.
For description, see R SOC 220.

R SOC 261 Sociology of Sustainable Development
Fall. 3 credits. L. Glenna.
For description, see R SOC 261.

[R SOC 490 Society and Survival
Fall. 3 credits. Not offered 2001–2002. Staff.
For description, see R SOC 490.]

S&TS 324 Environment and Society (also R SOC 324 and SOC 324)
Spring. 3 credits. L. Glenna.
For description, see R SOC 324.

[S&TS 453 Reflections on Scientific Personae: Visibility and Invisibility of the Body
Spring. 4 credits. Not offered 2001–2002. H. Mialet.
For description, see S&TS 453.]

S&TS 681 Philosophy of Science (also PHIL 681)
Spring. 4 credits. R. Boyd.
For description, see PHIL 681.

SOC 340 Health, Behavior, and Policy
Spring. 4 credits. S. Caldwell.
For description, see SOC 340.

C. Senior Seminars: Representative seminars listed below. Complete list available in 275 Clark Hall.

B&SOC 406 Biotechnology and the Law (also S&TS 406)
Spring. 4 credits. L. Palmer.
For description, see S&TS 406.

[B&SOC 427 Politics of Environmental Protection (also GOVT 427 and S&TS 427)
Fall. 4 credits. Not offered 2001–2002. Staff.
For description, see S&TS 427.]

B&SOC 447 Seminar in the History of Biology (also BIOEE 467, HIST 415, and S&TS 447)
Summer (6-week session). 4 credits. Limited to 18 students. W. Provine.
For description, see BIOEE 467.

B&SOC 461 Environmental Policy (also BIOEE 661 and ALS 661)
Fall and spring. 3 credits each term. Limited to 12 students. (Students must register for 6 credits each term since an "R" grade is given at the end of the fall term). D. Pimentel.
For description, see BIOEE 661.

[B&SOC 469 Food, Agriculture, and Society (also BIOEE 469 and S&TS 469)
Spring. 3 credits. Limited to 20 students. Not offered 2001–2002. A. G. Power.
For description, see BIOEE 469.]

COMM 421 Communication and the Environment
Spring. 3 credits. J. Shanahan.
For description, see COMM 421.

HD 418 Psychology of Aging
Fall. 3 credits. S. Cornelius.
For description, see HD 418.

HD 419 Midlife Development
Spring. 3 credits. S. Cornelius.
For description, see HD 419.

HD 366 Psychobiology of Temperament and Personality
Fall. 3 credits. R. A. DePue.
For description and prerequisites, see HD 366.

[HD 610 Processes in Human Development
Fall. 3 credits. Limited to 20 students. Not offered 2001–2002. U. Bronfenbrenner.
For description and prerequisites, see HD 610.]

HD 660 Social Development
Spring. 3 credits. Permission of the instructor required for undergraduates. C. Raver.
For description, see HD 660.

PAM 575 Housing and Long Term Care for the Elderly
Fall. 3 credits. P. Chi.
For description and prerequisites, see PAM 575.

[PAM 652 Health Care Services: Consumer and Ethical Perspectives
Fall. 3–4 credits. If using this course as a senior seminar, Biology & Society majors must take it for 4 credits. Enrollment limited; preference given to PAM students. Not offered 2001–2002. A. Parrot.
For description and prerequisites, see PAM 652.]

PAM 656 Managed Health Delivery Systems: Primary-Ambulatory Care
Spring. 3 credits. For undergraduate seniors only by permission of instructor. J. Kuder.
For description and prerequisites, see PAM 656.

PAM 659 Epidemiology, Clinical Medicine, and Management Interface Issues
Spring. 3 credits. E. Rodriguez.
For description, see PAM 659.

[R SOC 410 Population and Environment
Spring. 3 credits. Not offered 2001–2002. Staff.
For description, see R SOC 410.]

R SOC 438 Social Demography (also SOC 437)
Fall. 3 credits. D. Gurak.
For description, see R SOC 438.

R SOC 495 Population, Environment, and Development in Sub-Saharan Africa
Fall. 3 credits. P. Eloundou-Enyegue.
For description, see R SOC 495.

S&TS 411 Knowledge, Technology, and Property
Spring. 4 credits. S. Hilgartner.
For description and prerequisites, see S&TS 411.

S&TS 438 Minds, Machines, and Intelligence (also COGST 438)
Spring. 4 credits. H. Mialet.
For description, see S&TS 438.

[S&TS 466 Public Communication of Science and Technology (also COMM 466)
Fall. 4 credits. Limited to 15 students. Not offered 2001–2002. B. Lewenstein.
For description and prerequisites, see COMM 466.]

[S&TS 490 Integrity of Scientific Practice
Spring. 4 credits. Not offered 2001–2002. S. Hilgartner.
For description, see S&TS 490.]

S&TS 645 Genetics: Politics and Society in Comparative Perspective (also GOVT 634)
Spring. 4 credits. S. Hilgartner.
For description, see S&TS 645.

V. Other Courses

B&SOC 375 Independent Study
Fall or spring. 1–4 credits.
For description and prerequisites, see B&SOC 375.

[B&SOC 400 Undergraduate Seminar
Fall or spring. Variable credit. May be repeated for credit. Not offered 2001–2002.
For description, see B&SOC 400.]

B&SOC 498 Honors Project I
Fall. 3–5 credits. Staff.
For description and requirements, see B&SOC 498.

B&SOC 499 Honors Project II
Spring. 3–5 credits. Staff.
For description and requirements, see B&SOC 499.

Biometry and Statistics

Biometry is the application of mathematical and statistical techniques to the life sciences. Statistics is concerned with quantitative aspects of scientific investigation: design, measurement, summarization of data, and drawing conclusions based on probability statements. Students with ability in mathematics and an interest in its applications will find this a rewarding and challenging major.

The work of a statistician or biometrician can encompass research, teaching, consulting, and computing in almost any combination and in a wide variety of applications. Opportunities for employment are abundant in universities, government, and businesses ranging from large corporations to small consulting firms; salaries are usually excellent.

While satisfying course requirements for a major in biometry and statistics, students can also take a wide variety of courses in other disciplines. In fact, students are encouraged to take courses in applied disciplines such as agriculture, biology, economics, and the social sciences that involve numerical data and their interpretation.

Students majoring in this area are required to take a computer science course (e.g., Computer Science 100), mathematics courses (at least three semesters of calculus), Biometry and Statistics 100, 101, 102, 408–409, 421, 601–602, Industrial and Labor Relations 310, and Operations Research and Industrial Engineering 270. Experience gained through summer employment or work as an undergraduate teaching assistant is highly recommended. Students should contact Professor Steven J. Schwager for information.

Communication

The single most important thing to learn in college is how to assess and manage constantly changing information. The amount of information the public receives and is expected to understand is growing exponentially. Communication is taking a more central role in science, technology, business, and public policy. Increasingly, government, industry, and special interest groups rely on communication specialists to aid in managing information—collecting, sorting, interpreting or reinterpreting, summarizing, and making information understandable and accessible to the general public, to interest groups, and to decision makers in organizations. Effective information management requires a thorough understanding of the communication process.

Students who graduate from this department, have excellent speaking, writing, and listening skills. Communication majors are taught:

- Communication processes, such as how communication influences attitudes, opinions, and behaviors.
- How communication systems work in our society.
- How to apply their understanding of communication to solving problems in science, government, industry, health, and education.

The communication major is a program with a strong core of contemporary communication knowledge, theory, and practice. Required freshman courses are:

Fall semester:

COMM 120 Contemporary Mass Communication

COMM 121 Investigating Communication

Spring semester:

COMM 116 Communication in Social Relationships

COMM 117 Writing about Communication

This set of courses provides students with a basic understanding of communication and the communication process. These courses also provide a unique opportunity to link practical application (such as writing and critical analysis) with up-to-date research and knowledge about communication.

During the sophomore year, students take:

Fall semester:

COMM 201 Oral Communication

COMM 282 Communication Industry Research

Spring semester:

COMM 230 Visual Communication

After completing the courses in the core curriculum, all majors take an additional 12 credits in communication. Students can choose to concentrate in one of three focus areas:

- Communication in the Life Sciences. (Studies of the impact of communication on environmental, health, science, and agricultural issues, and public perceptions of risk.)
- Communication Planning and Evaluation. (Development of communication plans to solve problems for individuals or for organizations and evaluating the success of these plans.)
- Communication Systems and Technology. (Principles of how we use communication technologies and how we are influenced by these technologies.)

Detailed information on the distribution of courses is available from the department.

In designing the communication major, the faculty of the department has kept in mind the need for students to understand contemporary research-based knowledge about communication as well as their need to be competent communicators in the workplace and in society at large.

A minor in communication is pending. Please inquire if interested.

Crop and Soil Sciences

The Department of Crop and Soil Sciences provides instruction in three specializations: agronomy, crop science, and soil science. Employment opportunities are increased with practical experience, and the faculty of the department and the Career Development Office of the college are glad to help students search for relevant summer jobs and internship opportunities. Professional certification can also be obtained in these specializations.

Agronomy combines the study of crop production and soil management. It provides the student with a broad array of career opportunities after completion of the B.S. degree, including agricultural business, extension service work, and farming. Graduate school is also possible after a well-planned program. Students should take at least 12 credits of crops and 12 credits of soils and design the remainder of their curriculum to meet specific interests and goals. Some students pursue a major in agronomy with a concentration in international agriculture. Agronomy is also offered as a specialization within the plant sciences major field of study.

Crop science is the application of basic biological and ecological science to the improvement and management of the world's main field crops used for human food and livestock feed. Courses required include 18 credits of crops, 12 credits of plant biology, and 6 credits of soils. Students who anticipate a career in agricultural production or service after completion of the B.S. degree should take additional courses in economics, communication, plant pathology, entomology, and nutrition. Students planning graduate or professional study beyond the bachelor's degree should take advanced course work in organic chemistry and biochemistry, calculus, physics, and statistics. Crop science is also offered as a specialization within the plant sciences major field of study.

Soil science is a basic discipline important in ecology, engineering, agriculture, and conservation. The curriculum in soil science combines physical and biological training to address critical issues in environmental and agriculture management related to soils. Students take 18 credits in soil science, including four credits in the introductory course. In addition, chemistry, mathematics, physics, and microbiology are required, as well as six credits of crop science to satisfy the major. Soil science is also offered as a specialization within the Science of Earth Systems and the Environmental Science major fields of study.

Education

The Department of Education is currently redesigning its programs. Building on strong academic disciplines and grounding in socio-political, psychological, empirical and theoretical bases of educational practice, the department has two foci to meet societal demands for teachers of mathematics, science and agriculture and for leaders in non-formal educational settings: Teacher Education, and Adult and Extension Education. These two programs of study, largely at the graduate level, prepare leaders who will both engage in professional practice and improve educational processes through research, practice and scholarship. Our undergraduate program leads to provisional certification in agricultural education. The latest information on program developments may be found on our web site, http://ed.cornell.edu/education.

Adult and Extension Education. The purpose of the Adult and Extension Graduate Program of Professional Development is to promote social learning and civic engagement through participatory adult and extension education practice. Program coursework, research, and fieldwork integrate critical educational, philosophical, psychological, and sociological theories of democratic engagement of adult learners to support both domestic and international educational programs for sustainability in human and community development. As public universities focus a greater share of their research, teaching, and extension resources on critical environmental, economic, and social problems domestically and globally, the program provides opportunities for participants to examine who benefits from such efforts and in what ways. The program prepares educational scholars and professionals for leadership and activist roles in non-formal and community-based settings, including but not limited to adult education, agricultural education, adult literacy education, continuing education and staff development, domestic extension and community development, and international agricultural education and development. Using a reflective practice approach to professional development, graduate preparation includes the study of ethical, political, empirical, and theoretical bases of educational endeavors; analyses of current and historical practices in adult, extension, and international education; and the praxis of education in a global environment.

Programs of graduate study and professional development include:

Master's of Professional Studies (M.P.S.—Agriculture and Life Sciences) in Adult and Extension Education

The purpose of this program is to provide opportunity for professional development and graduate study for adult, extension, and international educators working in a variety of non-formal and community-based settings.

Master's of Science (M.S.) and Doctor of Philosophy in Education (Ph.D.) in Adult and Extension Education

The M.S. and Ph.D. programs of advanced graduate study are designed to provide intellectual and professional preparation of scholars and practitioners for faculty roles in higher education, leadership roles in non-formal and community-based educational agencies domestically and internationally, and activist roles in a variety of adult and extension education endeavors.

Teacher Education. The Teacher Education Program prepares teachers, teacher educators, and scholars in the areas of Agriculture, Mathematics, and Science. Students develop knowledge and expert practice skills to assume leadership positions in formal educational settings, including pubic and charter schools, private schools and other formal instructional centers. Through courses and field experiences, students gain knowledge of ethical practice, the teaching and learning process, and the social-political context of education, and integrate this with their specific content area of science, math, and/or agriculture. Building on the land-grant mission of Cornell, this program focuses on the improvement of public education through exemplary instruction, meaningful inquiry, and collaboration with public schools. Students become practitioners who have the intellectual resources and praxis to engage in educational practice that promotes engaged and informed citizens who participate in promoting positive social change.

Programs of professional development and graduate research studies include Teacher Education in Agriculture, Mathematics, and Science Program (TEAMS). The TEAMS Program prepares educational professionals who are recognized for the quality and significance of their teaching in the areas of Agriculture, Mathematics, and Science. The Program provides students with the opportunity to engage in coursework and field experiences that focus on the character and formation of cognitive abilities as well as subject matter expertise, critical and reflective thinking, the social context of schooling, the synthesis and communication of knowledge, professional development, and inquiry. Graduates of this program work in formal educational settings such as public and private schools, and in other areas where preparation in teaching and learning is highly desirable. There is also an Agricultural Education Undergraduate Certification Option (B.S.). Students enrolled in the undergraduate Education major or in one of the technical agriculture areas of the College of Agriculture and Life Sciences complete coursework in professional education in addition to their technical agriculture requirements. One semester of off-campus student teaching is required. Individuals who complete the Undergraduate Certification Option are eligible to apply for New York State provisional certification to teach agriculture in the public schools. Completion of a Master's degree within five years of graduation and two years of successful teaching are required for permanent certification.

Master of Arts in Teaching Certification Option (M.A.T.—Agriculture, Mathematics, and Science). Students enrolled in the M.A.T Certification Option complete a graduate curriculum of professional education, additional coursework in their content area(s), and one off-campus semester of student teaching. Graduates are eligible to apply for New York State provisional certification (grades 7–12) to teach one or more of the content areas emphasized in the program. Two years of successful teaching experience are subsequently required for permanent certification in New York State. Note that Undergraduates in science, mathematics, or agriculture majors should apply to the M.A.T program during their sophomore year. Students complete their undergraduate subject matter majors while taking selected courses in Education during their junior and senior years. Contact the TEAMS coordinator, 255–9573, for further information.

Master of Professional Studies—Non-Certification Option in Agricultural Education (M.P.S, Agriculture and Life Sciences). Students enrolled in the M.P.S Non-Certification Option in Agricultural Education complete a program of professional education, additional coursework in their technical content area(s), and an in-depth project. Graduates of this option work in formal educational settings that do not require state licensure (e.g., community colleges, private schools, industry), but do require a background in the planning, delivery, and assessment of instruction.

Graduate Studies in Curriculum and Instruction (Master of Science—M.S. and Doctor of Philosophy—Ph.D.). Graduate Studies in Curriculum and Instruction prepare scholars, researchers, and leaders in education who will work in colleges and universities, government agencies, foundations, and other institutions whose work is focused on formal education and its improvement. Graduates engage in disciplined inquiry addressing problems and issues of importance to the processes of teaching and learning and to the socio-political context in which schooling takes place. Each M.S. and Ph.D. student designs a program tailored to fit his/her personal and professional interests within the context of our Graduate Studies Program and its focus on teacher education. Applicants for the Ph.D. program should have teaching experience or comparable experiences in the public schools.

Effective College Teaching Series. The Center for Learning and Teaching, under the auspices of the Department of Education, offers a series of courses, both credit and non-credit, for the improvement of teaching at Cornell. Designed for Cornell faculty and graduate students who are either currently teaching or intending to teach. Contact the Center for Learning and Teaching, 5–6310, or www.clt.cornell.edu, for details.

Current offerings include:

EDUC 548 Effective College Teaching
Spring and one-week summer session. For faculty, and graduate students who intend to pursue an academic career. 1–3 credits.

EDUC 578 ITATP Cross-Cultural Classroom Dynamics, Language and Teaching Practicum
Fall and spring. For international graduate students who have, or will have, teaching assistantships. 2 credits.

ITATP follow-up course
Fall and spring. A non-credit course offered for international teaching assistants who have completed EDUC 578, but who need or desire continued work in classroom instructional and communication skills.

Graduate Teaching Development Workshops
Offered early in each fall and spring semester, this day-long series offers an array of workshops in teaching effectiveness, from teacher/student interactions to developing a teaching portfolio. Non-credit, open to all Cornell faculty and graduate teaching assistants.

EDUC 620 Internship in Education
Fall and spring. For CALS graduate teaching assistants or CALS teaching personnel who wish to extend their workshop experience through reflective practice and consultation with an instructional support specialist. Prerequisite: the CALS Graduate Student Professional Development Workshop. 1 credit.

Educational Leadership

The Institute for Community College Development (ICCD), a partnership with the State University of New York (SUNY), Cornell University, and community colleges is located in the Department of Education and draws on faculty with expertise in the personal and social competencies related to leadership. The Institute currently offers professional development for leaders in community colleges, a research program, and a course in leadership. Contact ICCD, (607) 255–9259, or on the web at iccd@cornell.edu for more information.

Current Offerings include:

Professional Development

The **Administrative Leadership Program** is designed for senior and mid-level administrators in academic, student affairs, professional, and foundation officers who are interested in current issues affecting community colleges and the way they operate their campuses. The three-day program is held during the summer at Cornell. The program includes opportunities for self-reflection and group problem-solving activities.

The **Great Teachers Seminar** and **Successful Teaching Conference** are designed for faculty interested in improving, learning about, and reflecting on their own theory and practice and on general principles of effective teaching and learning. The events are held in upstate New York in the spring and fall, respectively. Faculty from the Department of Education are frequent presenters.

The **Presidents Leadership Conference** is designed for current and future community college presidents who need information and ideas about leading a diverse, learning-centered campus that is connected to the local and global communities.

Research

The Institute research agenda is centered on leadership theory and practice, and on social and economic policies affecting education.

Education

EDUC 694 is a three credit course offered in the fall term. Analysis of Leadership Theories: Developing a Leadership Philosophy. Designed for faculty and administrators in higher education, particularly in the community colleges.

Entomology

The entomology curriculum provides students with a basic background in biological and environmental sciences, with a special emphasis on the study of insects. Majors may pursue graduate studies in entomology or related sciences upon completion of the B.S. degree. Alternatively, students may immediately begin careers in various aspects of basic or applied insect biology including integrated pest management, insect pathology, environmental assessment, medical or veterinary entomology, insect toxicology, apiculture, insect systematics, or insect ecology. Because of the diversity of career options, the major includes a common core of requirements allowing flexibility in electives selected by students in consultation with their advisers.

Specific requirements

Basic Sciences

- One year of college mathematics, including a course in calculus, may substitute statistics and biometry
- One semester of physics
- Chemistry 206–208 or 207–208 (General Chemistry)
- Chemistry 257 (Organic and Biological Chemistry)

General Biology

- Introductory Biology
- Biological Sciences 281 (Genetics)
- Biological Sciences 278 (Evolutionary Biology)
- A choice of one: Biological Sciences 261 (Ecology and the Environment) or Biological Sciences 330 or 331 (Principles of Biochemistry)

Entomology

- Entomology 212 (Insect Biology)
- A choice of two:
  - Entomology 322 (Insect Morphology)
  - Entomology 331 (Insect Systematics)
  - Entomology 483 (Insect Physiology)

Students must also enroll in at least two additional entomology courses offered at the 300–400 level on more specialized topics.

Environmental Science

Environmental Science is a new major for the College of Agriculture and Life Sciences that is pending approval. The proposed major provides an integrative and broad-based program in the physical, biological, and social sciences. The major consists of foundation courses and environmental core courses in earth, biotic, human, and economic systems. Students focus their upper-level study in a concentration or "environmental track," which provides expertise in a particular area. For more information about this new major, contact the Center for the Environment (cucfe@cornell.edu, or (607) 255–7535).

Food Science

The mission of the Food Science Program is to educate students for careers in food science and technology. Graduates are prepared for entry level positions in industry, government, and research organizations or for advanced study in food science and related disciplines. Food scientists qualify for satisfying careers which focus on ensuring the sustainable availability of a safe, nutritious, affordable, and high quality food supply for people throughout New York State, the nation, and the world.

Students choose one of five specialization options: (1) Basic Food Science; (2) Food Engineering; (3) Food Processing; (4) Food Operations and Management; and (5) Food Biotechnology. The first three options meet minimum curriculum standards set by the Institute of Food Technologists, the premier professional society for food scientists. Students choose an option based on individual interests and career goals.

The first two years of the program are focused on establishing a solid background in the physical and biological sciences, math, and communication. Required courses include chemistry (intro and organic), biology, microbiology, calculus, physics, freshman seminar, food science, and nutrition. The second two years emphasize the application of basic science and technology to the processing, storage, distribution, marketing, and final preparation of foods. Required courses include Food Engineering Principles, Physical Principles of Food Processing, Food Safety Assurance, Food Chemistry, Sensory Evaluation of Foods, Food Microbiology, and Statistics. Students choose electives to satisfy college distribution requirements and individual interests.

Students are strongly encouraged to participate in research supervised by a faculty member and/or to work as an intern in a food company during summer breaks. Most faculty in the department have active research programs and welcome participation by undergraduate students. Students may receive academic credit or wages for faculty-directed undergraduate research. Many food companies recruit on campus for their summer internship programs. These internships are excellent opportunities for students to gain experience and establish contacts for future employment.

A state-of-the art food processing and development laboratory, an operational dairy plant, and extensive laboratory facilities are available for training, research, and employment.

Landscape Architecture

Landscape Architecture focuses on the art of landscape design as an expression of the cultural values and the natural processes of the ambient environment. The program's unique place within the university promotes interaction among the areas of horticulture, environmental science, architecture, and city and regional planning.

The course of study prepares students for the practice of landscape architecture. The curriculum focuses on graphic communication, basic and advanced design methods, landscape history and theory, plant materials, construction and engineering technology, and professional practice. Design studios deal with

the integration of cultural and natural systems requirements as applied to specific sites at varying scales. Projects range from garden design, parks design, housing design, historic preservation, environmental rehabilitation, and urban design.

Landscape Architecture offers two professional degree alternatives: a four-year bachelor of science degree administered through the College of Agriculture and Life Sciences; a three-year Master of Landscape Architecture degree administered through the Graduate School for those who have a four-year undergraduate degree in another field. Both of these degrees are accredited by the Landscape Architecture Accreditation Board (LAAB) of the American Society of Landscape Architects. The major in each degree is composed of core courses related to professional education in landscape architecture, a concentration in a subject related to the core courses, and free electives.

The department also offers a two-year Master of Landscape Architecture Advanced Degree Program administered through the Graduate School, for those with accredited degrees in Landscape Architecture or Architecture. The two-year program entails core courses in the discipline and the development of a concentration in subject matter areas such as landscape history and theory, landscape ecology and urban horticulture, the cultural landscape, site/landscape and art, or urban design.

In addition, an undergraduate concentration in the American Cultural Landscape is available for nonmajors.

Dual Degree Options

Graduate students can earn a Master of Landscape Architecture and a Master of Science (Horticulture) or a Master of City and Regional Planning simultaneously. Students need to be accepted into both fields of study to engage in a dual degree program and must fulfill requirements of both fields of study. Thesis requirements are generally integrated for dual degrees.

Study Abroad

The faculty encourages study abroad and has two formally structured programs. The *Denmark International Study* (DIS) program is available primarily to senior undergraduates and third year graduates in the fall semester and is administered through Cornell Abroad. The *Rome Program* is made available to undergraduates and graduate students through the College of Architecture, Art, and Planning.

Bachelor of Science Landscape Architecture Degree Sequence: (Please note that each semester the studio classes require a supply and field trip fee and all landscape architecture majors are required to pay an annual technology fee.)

First Year

Fall Term	*Credits*
*LA 141, Grounding in Landscape Architecture	4
†Biological sciences elective	3
†Physical sciences elective	3
†Social sciences or humanities elective	3
†Written or oral expression elective	3
	16
Spring Term	
*LA 142, Grounding in Landscape Architecture	4
†Biological sciences elective	3
†Social sciences or humanities elective	3
†Written or oral expression elective	3
†Physical sciences elective	3
	16

Second Year

Fall Term	
*LA 491, Creating the Urban Eden: Woody Plant Selection, Design and Landscape Establishment	4
*LA 201, Medium of the Landscape	5
†Biological Sciences elective	3
†Social Sciences or Humanities elective	3
‡Free electives	2
	17
Spring Term	
*LA 202, Medium of the Landscape	5
*LA 315, Site Engineering I	3
*LA 492, Creating the Urban Eden: Woody Plant Selection, Design and Landscape Establishment	4
†Written or oral expression elective	3
†Physical sciences elective	3
	18

Third Year

Fall Term	
*LA 301, Integrating Theory and Practice	5
*LA 316, Site Engineering II (second 7 weeks)	2
**Concentration	3
*Historical studies	3
‡Free electives	2
	15
Spring Term	
*LA 302, Urban Design in Virtual Space	5
**Concentration	3
*Historical studies	3
*LA 318, Site Construction	5
	16

Fourth Year

Fall Term	
**Concentration	6
†Social sciences or humanities elective	3
‡Free elective	2
(Optional landscape architecture study abroad semester in Denmark or Rome)	11
Spring Term	
*LA 402, Integrating Theory and Practice: Community Design Studio	5
**Concentration	3
*LA 412, Professional Practice	1
‡Free elective	2
	11
Summary of credit requirements	
*Specialization requirements	58
†Distribution electives	39
‡Free electives	8
**Concentration	15
	120

Master of Landscape Architecture (M.L.A.) License Qualifying Degree

Requirements of the three-year M.L.A. curriculum include 90 credits, six resident units of satisfactory completion of the core curriculum courses, and a thesis or a capstone studio. (Please note that each semester the studio classes require a supply and field trip fee and all landscape architecture majors are required to pay an annual technology fee.)

First Year

Fall Term	*Credits*
*LA 505, Graphic Communication I	3
‡Free electives	2
*LA 501, Composition and Theory	5
*Historical Studies	3
*LA 491, Creating the Urban Eden: Woody Plant Selection, Design and Landscape Establishment	4
	17
Spring Term	
*LA 502, Composition and Theory	5
*LA 492, Creating the Urban Eden: Woody Plant Selection, Design and Landscape Establishment	4
**Concentration	2
*LA 615, Site Engineering I	3
*LA 590, Theory Seminar	3
	17

Second Year

Fall Term	
*LA 601, Integrating Theory and Practice	5
*LA 616, Site Engineering II	2
*Historical Studies	3
**Concentration	6
	16
Spring Term	
*LA 602, Integrating Theory and Practice	5
*LA 618, Site Construction	5
*Historical Studies	3
**Concentration	3
	16

Third Year

Fall Term

*LA 701, Urban Design and Planning	5
‡Free elective	3
**Concentration	4
	12

Spring Term

*LA 800, Master's Thesis in Landscape Architecture	9
or *LA 702, Advanced Design Studio	5
*LA 412, Professional Practice	1
‡Free elective(s)	2 or 6
	12

Summary of credit requirements

*Specialization requirements	64 or 68
**Concentration	15
‡Free electives	7 or 11
	90

Master of Landscape Architecture Advanced Degree Program. The two-year Master of Landscape Architecture (M.L.A./A.D.) program serves to broaden and enrich undergraduate education in design by providing an expanded educational experience to those who are technically skilled. Applicants must hold a Bachelor's Degree in Landscape Architecture or Architecture from an accredited program. The objective of the two-year (M.L.A./A.D.) program is to develop specializations for individuals who may wish to teach, practice, or conduct applied research in landscape architecture.

Students admitted to the two-year M.L.A./A.D. program are required to complete 60 credits of course work as approved by the members of their graduate committee. For landscape architects, this must include at least two advanced studios, a graduate seminar, a concentration, and a thesis. For architects the curriculum requires three advanced studios, two courses in plants and planting design, two courses in the history of landscape, two courses in site engineering, a seminar in design theory, a course in professional practice, a concentration, and electives.

Undergraduate Concentration for Nonmajors

Students outside the professional program may choose the undergraduate concentration in the American Cultural Landscape to complement their major. The courses center on the landscape as an object, something to be studied for its own sake, and as a subject, as a means to understand society and its relationship to natural systems and diverse cultures. The cultural landscape includes its visible elements as well as perceptions and cultural ideas and values. The concentration consists of four courses, two required and two electives. Students may petition to substitute one course in the electives list. Direct inquiries to professors H. Gottfried or S. Baugher.

Required.

Visual Studies (choose one):

Art 121 Introduction to Painting (3 cr)

Art 141 Introduction to Sculpture (3 cr)

Art 151 Introduction to Drawing (3 cr)

Art 158 Conceptual Drawing (3 cr)

Art 159 Life and Still-Life (3 cr)

Art 161 Photography I (3 cr)

DEA 101 Design I: Fundamentals (3 cr)

LA 141 Grounding in Landscape Architecture (3 cr)

The Landscape

+LA 282 The American Landscape (3 cr)

Electives (choose two):

Arch 390 American Architecture and Building I (3 cr.)

Arch 391 American Architecture and Building II (3 cr.)

+LA 260 Pre-Industrial Cities and Towns of North America (3 cr) offered alternate years

+LA 261 Urban Archaeology (3 cr)

+LA 262 Laboratory in Landscape Archaeology

LA 263 American Indians, Planners, and Public Policy (3 cr)

LANAR 525 History of American Landscape Architecture (3 cr)

LA 569 Archeology in Preservation Planning and Design (3 cr) offered alternative years

+Distribution Elective

Natural Resources

As the number of humans living on the Earth surpasses six billion at the start of the twenty-first century, knowing how to conserve and manage well our Earth's remaining biological resources and natural environments takes on increasing importance and urgency. The undergraduate curriculum in natural resources provides students with the concepts and tools needed to understand the Earth's environmental resources and ecological systems, and to participate with intelligence and foresight in their conservation and management. The department's program allows students flexibility to pursue a variety of paths to an integrated, broadly-based understanding of relationships of organisms to their environments, and ways in which humans affect, and are affected by, those relationships. Students are encouraged to understand the scientific, ethical, and societal basis for management and protection of natural resources and environments through the application of ecological principles and knowledge of societal needs.

The Future for Natural Resource Majors

Most students entering the department have a strong interest in the natural world and contributing in some way to greater harmony between humans and the environment. An undergraduate degree in natural resources prepares students to make these contributions as informed citizens with a strong liberal arts education and a firm grasp of the scientific, ethical, and societal dimensions of environmental conservation and management. It also prepares them for entry-level positions with conservation organizations, state and federal resource management agencies, environmental consulting firms, and environmental education centers, or for graduate study in several environmentally-related fields, including the biological, physical, and chemical sciences; forest, wetland, stream, wildlife, or fisheries management; and environmental law and public policy.

Because high-level positions in environmental fields usually require advanced study, most career-minded natural resource majors eventually pursue graduate or professional degrees. These students will assume positions of leadership in government, colleges and universities, national and international conservation organizations, environmental design firms, environmental consulting firms, the environmental divisions of private industry, and organizations involved in environmental education or communication.

Curriculum

Freshmen and sophomores all take a similar set of courses, many of which fulfill distribution requirements in the College of Agriculture and Life Sciences. These include courses in general biology and ecology, chemistry, mathematics, statistics, ethics, economics, and communication. They also take a series of four foundation courses designed to introduce them to the field of natural resources and environment. These courses include "Introduction to the Field of Natural Resources," "Environmental Conservation," "Field Biology," and "People, Values, and Natural Resources."

At the *junior and senior level*, students may specialize in one of three areas of concentration (see below). Within these concentrations, students take a prescribed number of courses from specified sets selected by the faculty to provide an in-depth understanding of key principles, concepts, and practices. They also have flexibility to gain exposure to a wide variety of environment-related courses offered by Natural Resources and other departments at Cornell, as well as to the University's many offerings that ground the student in a first-rate liberal arts education. All seniors participate in a senior experience, which they select from a number of departmental options. These options range from a research honors thesis to a senior field practicum or internship. They provide the student with an intensive experience in synthesis, integration, and critical thinking applied to current issues in the conservation and management of natural resources, ecological systems, or the environment.

Areas of Concentration

The concentration in **Applied Ecology** is designed as a foundation for those who wish to pursue careers or advanced study in science-based conservation or management of wild populations of animals and plants, conservation biology, control of invasive and overabundant species, watershed and landscape management, quantitative resource management, resource inventory and information management, global ecology, or applied ecology, and biogeochemistry of forests and wetlands. This concentration also may interest students seeking a biologically based approach to environmental science or global studies. Students who select this concentration typically focus their course work in the areas of species biology and applied ecosystem ecology, including quantitative analysis of fish and wildlife populations, ecosystems, and landscapes. They complement their course work within the department with courses in other departments, such as Ecology and Evolutionary Biology, Microbiology, Geology, Crop and Soil Sciences, Atmospheric and Earth Sciences, and Plant Sciences.

The concentration in **Resource Policy and Management** provides a foundation for students who wish to pursue careers or advanced study in the human dimensions or policy aspects of resource conservation and management. Students who select this concentration typically focus on courses related to the development of environmental policy, management strategies for particular species or ecosystems, or programs in environmental communication and education. They complement their course work within the department with courses in other departments such as Government, Rural Sociology, Communication, Applied Economics and Management, City and Regional Planning, and Policy Analysis and Management.

The concentration in **Environmental Studies** is intended for those who wish to obtain the broadest possible, yet rigorous, grounding in the wide range of subjects needed to understand human interactions with the environment. The program's emphasis is on developing an ability to think critically about these interactions. As juniors and seniors, students who choose Environmental Studies design a cohesive sequence of five courses in the social sciences, natural sciences, and humanities related to environment. Together with their departmental adviser, they decide on an environmental theme that the student wishes to pursue in depth. That theme should identify a specific set of interrelationships between humans and the environment that the student wishes to understand. For example, students could choose to explore themes such as evaluating legal and economic incentives for conservation or studying human views of the environment as expressed in literature or history. Many upper-division sequences of courses are acceptable if the student can formulate and defend a reasonable rationale for the choice of courses.

For details about the core curriculum in the Department of Natural Resources, consult our Web site at www.dnr.cornell.edu. Information also is available in the department's Undergraduate Program Office in 12 Fernow Hall.

Research and Work Opportunities for Undergraduates

The department offers many opportunities for field-oriented studies, independent research, internships, and jobs. These opportunities include several field-based courses and access for research to the department's Arnot Teaching and Research Forest near Ithaca, the Little Moose Field Station in the Adirondacks, and the Cornell Biological Field Station on Oneida Lake near Syracuse, as well as numerous natural areas near campus. Students also may choose to do independent research or work during the summer at the Hubbard Brook Forest in New Hampshire, New York's Adirondack Park, or in many types of forest, aquatic, and wetland ecosystems in New York and beyond where departmental faculty members have on-going research projects. Part-time jobs in the research and extension programs of several faculty members offer students many opportunities for career-related work experience. A research honors program is available for qualified students. In addition, the department coordinates an internship program for students and encourages students to seek relevant work experience to complement their academic studies.

Nutrition, Food, and Agriculture

Nutritional sciences draws upon chemistry, biology, and the social sciences to understand complex relationships among human health and well-being, food and lifestyle patterns, food and agricultural systems, and social and institutional environments.

The program in nutrition, food, and agriculture provides students with strong training in human nutrition in the context of an understanding and appreciation of the agricultural and life sciences. The program responds to the growing and important interrelationships of human nutrition and the agricultural and life sciences. Growing public interest in health and nutrition has placed new demands upon food producers, processors, and retailers. The problems of hunger and malnutrition in the United States and abroad require that nutritionists work together with specialists in areas such as agricultural economics, food production, and rural sociology. Advances in biotechnology provide researchers with new ways to understand human nutritional requirements and the regulation of human metabolism.

Nutrition, food, and agriculture majors complete a core set of requirements and choose elective courses in the areas of their particular interest. The core curriculum includes introductory chemistry and biology, organic chemistry, biochemistry, physiology, and mathematics. Students complete five courses in nutritional sciences: NS 115 Nutrition and Health: Concepts and Controversies, NS 245 Social Science Perspectives on Food and Nutrition, NS 345 Nutritional and Physicochemical Aspects of Foods, NS 331 Physiological and Biochemical Bases of Nutrition, and NS 332 Methods in Nutritional Sciences. In addition, students select a minimum of three advanced courses in nutritional sciences as well as elective courses in the broad areas of food production and processing, food and agricultural policy, the life sciences, environment and natural resources, communication, and education.

All majors have faculty advisers in the Division of Nutritional Sciences with whom they meet regularly. Advisers help students plan course schedules and help find opportunities for special study or experiences outside the classroom.

Many students engage in laboratory or field research with a faculty member for academic credit. The research honors program is designed for academically talented students who are interested in research. Honors students conduct independent research projects under the guidance of a faculty member and prepare an honors thesis. Many students participate in field experiences for credit during the academic year or summer. Placements in laboratories, industries, or community agencies are possible.

The major in nutrition, food, and agriculture can lead to many different career paths. By supplementing the core requirements with courses in different areas, students can prepare for jobs in industry, government, or community agencies in the United States or abroad. The major is excellent preparation for graduate study in a variety of fields.

The Division of Nutritional Sciences is affiliated with both the College of Agriculture and Life Sciences and the College of Human Ecology. Most of the Division faculty members work in Savage-Kinzelberg Hall and Martha Van Rensselaer (MVR) Hall. In addition to housing offices, classrooms, and seminar rooms, these buildings contain research facilities, specialized laboratories, a human metabolic research unit, and computer facilities. The nutritional sciences Learning Resource Center in MVR is used by students for study and small group discussion. The center contains class materials, computers, audio-visual aids, and supplementary books and periodicals for independent study and special projects.

For additional information about the nutrition, food, and agriculture program, contact the Division of Nutritional Sciences Academic Affairs Office, 335 MVR, 607–255–2628.

Plant Sciences

Plant Science is a multidepartmental program governed by faculty in the Departments of Crop and Soil Sciences, Horticulture, Plant Biology, Plant Breeding, and Plant Pathology. Students in the program share a common interest in learning about topics associated with plant growth and development in the broadest sense, and many have their sights set on careers in applied agricultural fields. In addition to the college distribution requirements, they must take at least one course in each of several areas including botany, plant physiology, ecology, taxonomy/systematics, genetics, statistics, plant-pest interactions, crop production, and soil science for a total of 40 credits.

Students who begin with well-defined interests or who identify certain areas of interest after several semesters of course work usually choose a specialization within one of the six cooperating departments. Each specialization has additional requirements beyond the basic core courses. However, students who are uncertain about the breadth of their interests or who are seeking as much flexibility as possible may choose to design their course of study without declaring a specialization. Those students have fewer required courses but are still expected to develop a strong background in plant science.

More than one hundred courses that deal directly with some area of plant science are offered by the cooperating departments, and other courses relating to plant science are offered elsewhere in the university. There are also ample opportunities for undergraduate teaching and research experience, and qualified students, especially those expecting to go on for graduate degrees, are encouraged to avail themselves of such opportunities. Students who are planning to enter the work force immediately upon completion of the B.S. degree are encouraged to obtain practical experience. This may involve summer employment in a plant production or maintenance related industry such as a lawn and tree care company, commercial greenhouse, nursery, botanical garden or arboretum, crop production farm or with Cooperative Extension. Plant Science faculty also encourage students to avail themselves of opportunities to work and/or study abroad.

In addition to classrooms and laboratories in five buildings on the Cornell campus proper, research and teaching facilities adjacent to the campus provide students with ample opportunities for hands-on practice, technical training, independent research projects, and internships in plant science. Facilities available

to students include research orchards and vineyards, golf courses and a turf research facility, the Cornell Plantations, Arboretum and natural areas, two vegetable crop farms. Demonstration/research facilities in Aurora (Cayuga County), Geneva (Ontario County), Highland (Ulster County), Lake Placid (Essex County), Middletown(Orange County), Odessa (Tioga County), and Riverhead, (Suffolk County) are also sites administered by departments in the Plant Science consortium and are available for undergraduate and graduate field study.

Crop Science and Agronomy are specializations that focus on the science and management of the major food crops of the world such as wheat, corn, rice, soybean, and alfalfa. In addition to several courses in Crop Science, students in this program also take courses in the sister disciplines of weed science, seed science, and soil science. At present, the specialization is described in detail under the major field of study called Crop and Soil Sciences, but it will become a part of the Plant Science major field of study in the near future.

Horticulture. Derived from the Latin word "hortus," meaning garden, horticulture is a blend of science and culture involving knowledge of plants in farms and gardens, parks and landscapes, athletic and recreational facilities, indoor plants, greenhouse and nursery plant production, and crops used for wines, herbs and spices, medicinal purposes, coffee and teas. The knowledge and skills essential to grow, maintain, process and market horticultural plants are in high demand in a world increasingly concerned with environmental quality, recreation, and health.

There are about 40 faculty members in horticulture–specializing in almost every aspect of horticultural science, with active research and outreach programs regionally, nationally and internationally.

Students choosing a concentration in Horticulture must complete the minimum 40-credits of core courses for the Plant Science major, plus the following courses:

HORT 101-Horticultural Science and Systems (4 credits)

HORT 400-Plant Propagation (3 credits)

Two HORT courses in plant production or management at the 400 level (6 credits).

One additional course of integrated pest management (plant pathology, entomology or weed science) beyond the 3-credit Plant Science core requirement (3 credits).

Students transferring into Cornell from other colleges can petition to waive or adjust these requirements, in consultation with their faculty advisers.

Plant Biology stresses a basic, rather than applied, understanding of how plants function, grow and develop, as well as a study of their genome, evolution and relationships to man. It provides undergraduates with a thorough preparation for graduate study in plant sciences. In cooperation with an adviser each student plans a curriculum with a concentration in basic sciences, supplemented by more advanced courses in plant biology. Students specializing in Plant Biology within the Plant Science major should take a minimum of four courses beyond the core of Plant Science courses. Options include plant molecular biology, plant cell biology, biochemistry, ethnobotany, and further courses in the function, growth, genetics, systematics, ecology and evolution of plants. Individual research under professorial guidance is encouraged. Different options within Plant Biology afford a flexible curriculum.

Plant Genetics and Breeding relates information about genetics/genomics of plants to the improvement of cultivated plant species. Agriculturally important genes are identified, characterized and deployed through combinations of molecular studies and sexual crosses. This area of study integrates genetic information with plant physiology/biochemistry, plant pathology, entomology, conservation biology, international agriculture, and related areas in order to create crops that meet the needs of modern society. In addition to the core plant science courses, students should take PLBR 201, 401, 403, and 404. Other courses may be included after consultation with the adviser. Students are encouraged to participate in research projects and take advantage of opportunities for internships in industry.

Plant Pathology is the study of plant disease—its causes and how they are identified, the molecular basis for pathogenicity and resistance, and disease management. For most students, a concentration in plant pathology as an undergraduate is preparation for graduate study in plant pathology or another field of plant science. However, study in plant pathology also prepares students for careers as technical representatives with agribusiness firms, Cooperative Extension educators, integrated pest management practitioners, state or federal plant pest regulatory agents, and laboratory technicians. Suggested courses beyond the plant science core include organic chemistry and biochemistry, calculus, introductory plant pathology, plant disease diagnosis, mycology, entomology, and plant breeding.

Plant Protection is offered to students who are interested in the management of plant pests. It includes the study of insects, diseases, weeds, vertebrate pests, and other factors that prevent maximum crop production. Although designed as a terminal program for students desiring practical preparation for careers in pest management, the specialization can also provide an adequate background for graduate work in entomology, plant pathology, or weed science.

Rural Sociology

Technological, economic, demographic, and environmental changes are social processes, and each has major impacts on individuals, social groups, societies, and the international order. At Cornell, rural sociology students study these and other facets of social change in both domestic and international settings. Among the topic areas in which faculty members in the Department of Rural Sociology specialize are international agricultural and rural development, community and regional development and changes in the United States, environmental sociology, aging and the life course, sociology of agriculture, rural industrialization and labor markets, technology and social change, population and development, political economy, women in development, race and ethnic relations, and research methodology. Most courses provide background in both domestic and international aspects of the subject matter. Normally, students will develop a specialization with either a domestic or international emphasis by choosing appropriate elective courses. All students learn the theory and methodology of sociology, and how to apply both to research and policy in their subject areas.

Recognizing that students are concerned with future career opportunities, the undergraduate program emphasizes acquisition of skills as well as general knowledge in preparation for jobs or further study upon graduation. Accordingly, students are expected to become involved in the application of theory, methodology, principles, and concepts in the analysis of practical problems.

Rural sociology offers degree programs at both the undergraduate and graduate levels (B.S., M.S., M.P.S., or Ph.D.). These programs are offered through the Department of Rural Sociology and the Graduate Field of Development Sociology, both of which are located in Warren Hall. For many years, the department and graduate field have been recognized as among the top programs in the country, and both are known for innovative program orientations. The department is particularly well known for providing instruction in international as well as domestic aspects of community and rural development, environmental sociology, sociology of agriculture, population studies, and other topics. Faculty members in this department are committed to both quality instruction and research programs. Being located in a college of agriculture, faculty members maintain strong ties to the technical fields within the college as well as with the International Agriculture Program, the Biology and Society Program, the Cornell Institute for Social and Economic Research, the Community and Rural Development Institute, the Gender and Global Change Program, the Life Course Institute, the Rural Development Program, the Hispanic Studies Program, the Program on Science, Technology, and Society, and the Center for International Studies. Nearly half of the department faculty are associated with one or more area studies programs (the Southeast Asia Program, South Asia Program, Latin American Studies Program, East Asia Program, or the Institute for African Development). Department members also maintain working relations with faculty in the Department of Sociology and other social science units located in other colleges at Cornell. Students are encouraged to supplement their course work by electing courses in these other departments and programs, thereby rounding out their educations with different perspectives.

The courses offered in rural sociology can be grouped into three broad categories: development sociology; population, environment, and society; and social data and policy analysis. All students majoring in rural sociology are required to take five core courses: an introductory course (R SOC 101), methods (R SOC 213), theory (R SOC 301), social stratification (R SOC 370), and a course in statistics. Four elective Rural Sociology courses are also required of all majors.

The focus area in development sociology provides an understanding of the processes and policies that influence social and economic development in rural settings in North America and low-income countries in the developing world. Courses provide background in the sociology of development in both the advanced and developing

countries. Students normally select a set of elective courses in which either domestic or international development is emphasized. These courses provide background in several aspects of development sociology, including: (1) an understanding of the processes of socioeconomic development in low-income or Third World countries and training in the formulation of strategies to enhance the socioeconomic well-being of citizens of those countries; (2) analysis of the social structures and processes for development in nonmetropolitan settings in the United States; (3) analysis of the processes of agricultural change and development in industrialized and low-income countries; and (4) an understanding of the processes of technological development and change in agriculture and other rural industries in developed and developing countries.

Students are encouraged to complement courses in the department with course work in the history and economics of development, area studies, and the policy sciences.

Courses in the population, environment, and society focus area provide an understanding of (1) the causes and consequences of the major components of population change—fertility, mortality, and migration; (2) the major patterns of population distribution and population characteristics in the United States and the developing world; (3) the relationships between social structure and the biophysical environment; (4) the relationships between population change and natural resource utilization in development; and (5) impacts of public policy interventions on population size, growth, and composition or on natural resource availability and environmental quality. Students normally select the elective courses for the major so as to stress either population studies or sociological aspects of natural resources and the environment.

Students are encouraged to complement courses in the department with course work in demographic methods, household analysis, ecology and evolution, environmental studies, natural resources, and policy sciences.

Courses in the social data and policy analysis focus area provide: knowledge of research methodology, statistics, and computer applications; an understanding of social, economic, political, and historical concepts essential for conducting meaningful analyses of practical problems and issues faced by organizations, communities, regions, and states; and knowledge and practice in policy analysis. Students ordinarily select electives in order to specialize in either policy analysis or in a particular area of public policy (international development policy, domestic rural development policy, environmental policy, or population policy, etc.).

Students are encouraged to complement courses in the department with course work in data collection and research design, evaluation research, computing, and advanced statistics.

Science of Earth Systems (SES)

During the past several decades, with the increasing concern about air and water pollution, nuclear waste disposal, the destruction of the ozone, and global climate change, the scientific community has gained considerable insight into how the biosphere, hydrosphere, atmosphere, and lithosphere systems interact. It has become evident that we cannot understand and solve environmental problems by studying these individual systems in isolation. The interconnectedness of these systems is a fundamental attribute of the Earth system, and understanding their various interactions is crucial for understanding our environment.

The SES major emphasizes the rigorous and objective study of the Earth system as one of the outstanding intellectual challenges in modern science and as the necessary foundation for the future management of our home planet. Cornell's strengths across a broad range of earth and environmental sciences have been fused to provide students with the tools to engage in what will be the primary challenge of the twenty-first century. The SES major has its home in the Department of Earth and Atmospheric Sciences, but relies on the collaboration of several departments across the university.

The SES curriculum includes a strong preparation in mathematics, physics, chemistry, and biology during the freshman and sophomore years. During the junior and senior years, students complete the SES core sequence, studying such topics as climate dynamics, Earth system evolution, and biogeochemistry. These classes emphasize the interconnectedness of the Earth system, and are team-taught by professors from different traditional disciplines. The selection of upper-level "concentration" courses allows the student to develop an area of expertise that complements the breadth of the introductory and SES core courses. Possible areas of concentration include climate dynamics, biogeochemistry, ecological systems, environmental geology, ocean sciences, environmental biophysics, hydrological system, and soil science.

The SES major provides a strong preparation for graduate school in any one of the Earth system sciences, such as atmospheric sciences, geology/geophysics, oceanography, hydrology, ecology, and biogeochemistry. Students seeking employment with the B.S. degree will have many options in a wide variety of environmentally oriented careers in both the private sector and government. Students with the strong science background provided by the SES major are also highly valued by graduate programs in environmental law, public affairs, economics, and public policy. In addition, the emphasis on basic science makes the SES major excellent preparation for medical school.

The requirements for the major are as follows:

1. Basic Math and Sciences

This part of the SES curriculum builds a strong and diverse knowledge of fundamental science and mathematics, providing the student with the basic tools needed in upper-level science classes.

a. MATH 191 or 193, and MATH 192 (or MATH 111, 112)

b. PHYSICS 207 and 208 (or PHYSICS 112, 213)

c. CHEM 207 and 208

d. BIOGD 101/103–102/104 (or 105–106) or BIOGD 109/110

e. Three additional 3–4 credit courses in basic science and math, generally 100 and 200-level classes. At least one of the following courses must be included in the selection:

GEOL 201 Physics and Chemistry of the Earth

BIOEE 261 Ecology and the Environment

Other examples are MATH 293 and MATH 294, biochemistry, organic chemistry, PHYS 214, and introductory statistics. With the exception of the introductory statistics course, the additional basic courses will require at least one of the classes listed above as a prerequisite.

2. Science of Earth Systems Core Courses

Three 4-credit courses that emphasize the interconnectedness of the Earth system are required. These classes are founded on the most modern views of the planet as an interactive and ever-changing system, and each class crosses the traditional boundaries of disciplinary science.

EAS 302 Evolution of the Earth System

EAS 331/ASTRO 331 Climate Dynamics

EAS 321/NATRES 321 Biogeochemistry

3. Concentration Courses

Four intermediate to advanced-level courses (300-level and up) that build on the core courses and have prerequisites in the basic sciences and mathematics courses. These classes build depth and provide the student with a specific expertise in some facet of Earth system science. The concentration should be chosen before the junior year in consultation with an SES adviser whose interests match those of the student.

For more information contact Professor Kerry H. Cook, Department of Earth and Atmospheric Science, khc6@cornell.edu, and visit the web site: www.geo.cornell.edu/ses/

Special Programs in Agriculture and Life Sciences

General Studies. The opportunity to develop an independent major in General Studies is available for students interested in pursuing a general education in Agriculture and Life Sciences. In consultation with a faculty adviser, students may plan a sequence of courses suited to their individual interests, abilities, and objectives in an area not encompassed by the existing programs. In addition to the distribution and other college requirements, this major may include a concentration of courses in one of several academic units of the college or university.

Students completing this major are often planning a career in agriculturally related food and service enterprises. Many of the fast-growing occupations require the broad perspective, the scientific and technical skills, the attitudes and the analytical ability that a general education fosters.

General Studies includes production agriculture as well as technical work in the agricultural and life sciences. Many biotechnology concerns deal with aspects of agriculture, especially plants, crops, and ecosystems in the natural environment. A strong grounding in biological sciences as well as knowledge of the agricultural sciences is essential in this rapidly growing field. Students should plan basic course work in the major areas of study in the college—animal sciences, plant sciences, environment and technology,

agronomic sciences, biological sciences, and social sciences. Advanced courses may be selected in these and other areas of individual interest or career aspiration. A course of study for a special program must be planned with and approved by a college faculty adviser. Information on the options and names of faculty advisers prepared to advise in special programs are available in the Counseling and Advising Office, 140 Roberts Hall.

International Agriculture provides students with an understanding of the special problems of applying basic knowledge to the processes of agricultural development in low-income countries. The student typically specializes in a particular subject and works with an adviser to plan a program oriented toward international agriculture. The courses in International Agriculture are designed to acquaint students with the socioeconomic factors in agricultural development, with the physical and biological nature of tropical crops and animals, and the various world areas for which study programs exist. Study of a foreign language is required.

In addition to the college distribution requirements, students in International Agriculture must take a minimum of 30 credits toward the major. A minimum of seven credits in International Agriculture and eight credits in a modern foreign language are required. Students are expected to complete an overseas field experience of a minimum of six weeks. The other courses recommended are drawn from a wide range of disciplines. The objective is to familiarize students with the many facets of agricultural development in low-income countries. Students are encouraged to take additional specialized courses in one of the other program areas of the college.

International Studies Certificate Program for CALS Undergraduates

Preparing for leadership in an increasingly interconnected and dynamic world, CALS undergraduates need knowledge, skills and attitudes that build "global competencies." The certificate program for CALS students *not* majoring in International Agriculture will recognize an international concentration of coursework and experiences.

Requirements

- Four courses with significant international content, as recommended by students' major departments (2 should be from CALS).
- One semester of the Global Seminar, INTAG 480.
- Four semesters of foreign language instruction, or demonstrated language competency equivalent to that achieved by the end of the 4th semester of instruction at Cornell.
- An approved overseas experience (exchange, study abroad program, internship or faculty-led short course).

For more information contact the Student Services Coordinator in the International Agriculture Program Office, 31 Warren Hall, (607) 255–3037.

DESCRIPTION OF COURSES

Undergraduate and graduate courses in the college are offered through the academic departments and units and also through the Biological Sciences undergraduate program and the Division of Nutritional Sciences.

Descriptions of undergraduate and graduate courses are arranged by department, in alphabetical order.

Graduate study is organized under graduate fields, which generally coincide with the departments. Graduate degree requirements are described in the Announcement of the Graduate School. Courses for graduate students are described in the section on the academic department that offers them.

INTERDEPARTMENTAL/ INTERCOLLEGE COURSES

American Indian Studies

American Indian Studies is the instructional component of the American Indian Program (AIP). It is a multidisciplinary program offering course work that enhances students' understanding of the unique heritage of North American Indians and their relationship to other peoples in the United States and Canada. Students are challenged by such topics as the sovereignty rights of Indian nations and the contemporary relevance of Indian attitudes toward the environment. The program's instructional core consists of courses that focus on American Indian life from pre-contact times to the present and feature the perspectives of Native American people.

The American Indian Program offers a concentration in American Indian Studies to undergraduate students in conjunction with their major defined elsewhere in the university. The concentration will be earned upon completion of five courses: American Indian Studies 100 and American Indian Studies 175, plus three other courses selected from the American Indian Studies course listing, for a total of at least 15 credits. Students choosing a concentration in American Indian Studies should obtain application materials from the AIP office in 450 Caldwell. AIP also offers a graduate minor.

Students interested in choosing the minor should contact Daniel Usner, American Indian Program, (607) 255–8402.

D. H. Usner, Director; B. Baker, S. Baugher, C. C. Geisler, A. Gonzales, B. Lambert, J. Mt Pleasant, R. W. Venables

AIS 100 Introduction to American Indian Studies (also R SOC 100)
Fall. 3 credits. W 7:30–10:30 P.M. plus sections. R. W. Venables.
Slide lectures survey the rich cultures and complex histories of the Indian nations north of Mexico. Indian arts and philosophies are compared and contrasted with those of Europe, Africa, Asia, Canada, and the United States. The origins of today's major legal issues involving American Indians are also discussed. The course begins with a survey of Indian America before Columbus and ends at Wounded Knee in 1890, the event which marks the end of the conquest of Indian America. Guest lecturers, including American Indian leaders, provide additional perspectives.

AIS 175 Indian America in the 20th Century (also R SOC 175)
Spring. 3 credits. M W 11:15–12:05 plus sections. B. Baker.
This course addresses major U.S. policies affecting American Indians in the 20th Century, and ways in which American Indians pursued strategies to sway the process of social change. American Indian political, economic, and cultural issues are examined through history, literature, art, and film. The approach of this course is interdisciplinary and an emphasis is placed on the study of American Indians as living cultures. Current trends are discussed, and the implications for American Indians in the 21st Century are explored. Guest lecturers, including American Indian scholars and leaders, provide additional perspectives.

[AIS 209 Political History of American Indians in the U.S. (also HIST 209)
4 credits. Seminar designed for underclassmen but open to all students. Enrollment limited to 15 students. Not offered 2001–2002. D. H. Usner.
An investigation of political organization and change among Native American societies. Discussions and assignments examine forms of tribal government, diplomacy, and warfare, as well as political relations with European colonies and the United States. Specific topics include pan-Indian confederacies, Indian policy, struggles over sovereignty, and Indian strategies of autonomy and resistance.]

AIS 230 Cultures of Native North America (also ANTHR 230)
Fall. 3 or 4 credits. M W F 1:25–2:15. B. Lambert.
A survey of the principal Inuit and American Indian culture areas north of Mexico. Selected cultures are examined to bring out distinctive features of the economy, social organization, religion, and worldview. Although the course concentrates on traditional cultures, some lectures and readings deal with changes in native ways of life that have occurred during the period of European-Indian contact.

[AIS 260 Introduction to American Indian Literatures (also ENGL 260 and AM ST 260)
4 credits. Not offered 2001–2002. Staff.
An introduction to Native American literatures, a variety of genres—novels, short fiction, autobiography, poetry, oral traditions—are covered spanning Indian publications through the last two centuries. Issues arising from the texts include aesthetics of orality and literacy; cultural change and survival; colonial identity politics; mythic histories; worldviews and ideologies; and contemporary tribal sovereignty. A goal of the course is to read historical American contexts through the eyes of Native American texts.]

[AIS 261 Urban Archaeology (also LA 261 and CRP 261)
4 credits. Not offered 2001–2002. S. Baugher.
Urban archaeologists study American Indian, colonial, and nineteenth-century sites which now lie within the boundaries of modern cities. This course explores how urban centers evolve; what lies beneath today's cities; and how various cultures have altered the urban landscape. Students participate in a local archaeological excavation.]

[AIS 276 American Indian History, 1500–1850 (also HIST 276 and AM ST 272)
4 credits. Not offered 2001–2002.
D. H. Usner.
A survey of North American Indian history from the sixteenth century to the mid-nineteenth century. Relations between Indian nations and with European colonies are explored. Different cultural groups and cross-cultural encounters are compared, with emphasis on resistance and adaptation to European colonialism. The formative years of U.S. Indian policy and the experiences of Indian people through the removal era also receive close attention.]

[AIS 277 American Indian History Since 1850 (also HIST 277)
4 credits. Not offered 2001–2002.
D. H. Usner.
A historical study of American Indians in the United States and Canada from the mid-nineteenth century to the present. The active and complex role played by Indian people in their responses to government policies and to socioeconomic changes are emphasized. Challenges faced and initiatives taken by Indians are traced from the early reservation years to the current era of self-determination. Cultural change and continuity within Indian communities is closely examined.]

AIS 318 Ethnohistory of the Northern Iroquois (also R SOC 318)
Spring. 3 credits. Enrollment limited to 20. T 1:25–4:25. R. W. Venables.
The development of Iroquois (Houdenosaunee) history and culture is traced to the present day.

AIS 329 Indians, Settlers, and Slaves in the Early South (also HIST 329)
Spring. 4 credits. M W 10:10–11:00 plus sections. D. H. Usner.
History of the American South from the sixteenth century to the early nineteenth century with an emphasis on intercultural relations. Topics include colonization of the region by Spain, England, France, and the United States. American Indian adaptation and resistance, the evolution of slavery, African American relations with Europeans and Indians, and the role of racial ideology and ethnic identity in the formation of the South as a distinct section of the United States.

[AIS 360 Preindustrial Cities and Towns of North America (also LA 360 and CRP 360)
3 credits. Not offered 2001–2002.
S. Baugher.
Considers how various American Indian civilizations as well as diverse European cultures have exerted their influences on the organization of town and city living. Each culture has altered the landscape in their own way as they created their own built environments.]

[AIS 361 Sociology of American Indians (also R SOC 360)
Spring. 3 credits. Prerequisite: R SOC 101/SOC 101 or approval of instructor. Enrollment limited to 20. Not offered 2001–2002. W 2:30–4:25. B. Baker.
This course is designed to emphasize the role of theory and research in our understanding of American Indians. Towards that end, the relationship between the nation-state and indigenous populations is emphasized. Students are exposed to the following theoretical perspectives: world systems and dependency, internal colonialism, social disintegration, the social construction of reality, political mobilization, and ethnic reorganization. The course is also historical and comparative, as students study different Indian tribes located in the United States and Canada.]

[AIS 363 American Indians, Planners, and Public Policy (also LA 363 and CRP 363)
3 credits. Not offered 2001–2002.
S. Baugher.
Decisions made by public agencies and private enterprise too often lead to the flooding, polluting, strip-mining, or other destruction of American Indian reservations, archaeological sites, and burial grounds. The central focus of the course is how to address urban and regional problems without imperiling the cultural survival of minorities.]

AIS 367 American Indian Politics and Policy (also R SOC 367)
Fall. 3 credits. Enrollment limited to 20. T R 2:55–4:10. B. Baker.
This course addresses the Constitutional basis of the Federal-Indian relationship through an examination of treaties, Supreme Court decisions, and Congressional law-policy. The effects of European and American forms of governance on traditional American Indian political structures are detailed and contrasted with contemporary tribal governments and political organizations. Issues relating to sovereignty and self-governance with respect to American Indian tribal governments are addressed relative to state and federal governments.

[AIS 429 Undergraduate Seminar in Indians of Eastern North America (also HIST 429)
4 credits. Not offered 2001–2002.
D. H. Usner.
A seminar examining the history of Native Americans in the eastern woodlands from colonial times to the present. The cultural and economic participation of Indians in the evolution of frontier societies is examined. Major topics include fur-trade networks, political relations, removal, and the persistence of Indian communities in eastern states.]

AIS 442 American Indian Philosophies: Selected Topics (also R SOC 442)
Spring. 3 credits. Prerequisite: permission of instructor. Enrollment limited to 15. R 1:25–4:25. R. W. Venables.
This course provides an opportunity for students to read and discuss a wide range of American Indian philosophies.

AIS 450 Practicum in American Indian Studies
Fall. 4 credits. Prerequisites: AIS 100 or 175; one additional AIS course at the 200 level or higher; and permission of instructor. F 2:30–4:25. B. Baker.
As a *service learning* initiative, this course provides students with the opportunity to work in American Indian reservations or urban communities. Students apply knowledge and skills derived from their AIS coursework and major field of study under the supervision of Cornell faculty affiliated with the American Indian Program and representatives from Indian communities. Students are expected to contribute to the goals and objectives identified by Indian communities during the semester. Students meet in a weekly seminar where they engage in critical dialogue and reflection about the experience relative to academic knowledge. Students also write a series of short papers and submit a final project at the end of the semester.

[AIS 600 American Indian Studies
4 credits. Not offered 2001–2002. Staff.
This seminar surveys the field of American Indian Studies across different academic disciplines. Designed specifically for students considering the graduate minor in American Indian Studies, it offers some common intellectual ground beyond the more specialized avenues of scholarship. Various areas of study are explored, with an emphasis on current methods, theories, and problems involved in researching Indian topics in Canada and the United States.]

[AIS 624 Graduate Seminar in American Indian History (also HIST 624)
4 credits. Not offered 2001–2002.
D. H. Usner.
This seminar examines, through a selected series of major topics and problems, the historical study of North American Indians. Emphasis is placed on current interpretations and directions.]

AIS 665 Topics in Native American Societies and Cultures (also ANTHR 665)
Spring. 4 credits. B. Lambert.

Department of Statistical Science

The university-wide Department of Statistical Science coordinates undergraduate and graduate study in statistics and probability. A list of suitable courses can be found in the "Interdisciplinary Centers, Studies, and Programs" section at the front of this catalog (see p. 24).

NONDEPARTMENTAL COURSES

ALS 101 Transition and Success to Cornell
Fall. 1 credit. Prerequisites: must be an entering student in CALS. Letter grade only. B. O. Earle and CALS Career Development Office.
Discussion-oriented course to enable all new CALS students to enjoy their experience at and transition to Cornell. Lecture, discussion, guest speakers, and assignments that explore Cornell's history, services, and organizations are used. Emphasis on role of Agriculture and Life Sciences in future of all related careers.

ALS 134 Emergency Medical Technician
Fall and spring. 3 credits. S-U grades optional. Prerequisite: none—but basic and advanced first aid recommended. Lec, M 1:30–5:00; lab, W 1:30–5:00.
D. A. Grossman, P. Rach and A. E. Gantert.
E.M.T. is an intensive 140-hour course taught throughout the fall and spring semesters. Enrollment, therefore, occurs in the fall term only. Course includes training in C.P.R. for the professional rescuer, oxygen administration, airway management, fracture management, bleeding control, patient assessment, spinal immobilization, medical antishock trousers, and defibrillation. Students will qualify for the New York State E.M.T. Certification Exam upon successful completion of the course. Classes are conducted in the Teagle Hall second-floor classroom.

ALS 400 Internship
Fall, spring, or summer. 6 credits maximum. Not open to students who have earned internship credits elsewhere or in previous terms. S-U grades only.
Students may register only for internships in the New York State Assembly Intern Program, the New York State Senate Session Assistant's Program, and the Albany Semester Program. A learning contract is negotiated between the student and the faculty supervisor(s), stating conditions of the work assignment, supervision, and reporting. Participation is required in any structured learning activities associated with the internship.

ALS 402 Agricultural Study Tour to Burgundy, France
Spring. 2 credits. Prerequisite: must be a registered CALS student. S-U grades optional. L. A. Weston and P. Durand.
A two-week study tour held in the month of May in Burgundy, France. Students experience French agriculture, history, and cuisine. Tour includes wine, fruit, vegetable, cheese dairy, beef and poultry production, and French university facilities featuring modern agricultural research. Ten- to twenty-page paper requirement. Students travel throughout Burgundy and Eastern France with Pascal Durand, professor at ENESAD in Dijon France.

ALS 403 Internship Opportunities in Burgundy, France
Spring. Variable to 4 credits. Prerequisites: enrollment in the Agricultural Study Tour of Burgundy, France. Some French language experience preferred. S-U grades optional. L. A. Weston and P. Durand.
Six- to eight-week internship experiences in Burgundy, France in agriculturally related subject areas including viticulture, agribusiness, agronomy, food science, and biotechnology. Final paper documenting internship experience required.

ALS 477 Environmental Stewardship in the Cornell Community
Fall and spring. 2–4 variable credits. T R 11:40–1:10. J. M. Regenstein plus a faculty adviser.
Each student undertakes an original project to improve the environment at Cornell while working with a faculty adviser and the Cornell infrastructure (generally campus life and/or facilities). Through seminar discussions and presenters on environmental activism, students learn how to be more effective at developing environmental programs in the future, both during and after college. The final written project report is also presented orally at a public forum. (Note: If students prefer to take one or two credits of independent research in a department in the College of Agriculture, this can be arranged. Assistance in finding a faculty adviser is provided. This course may be taken more than once.)

ALS 480 Global Seminar: Environment and Sustainable Food Systems (also EDUC 480 and INTAG 480)
Spring. 3 credits. Prerequisite: juniors, seniors, and graduate students. Letter grade. Lec, R 8:00–9:55 A.M.; lab, 3:35–4:25 P.M. scheduled, one additional hour unscheduled. H. D. Sutphin, P. A. Arneson, and D. Lee.
A distance learning course involving Cornell and universities in Australia, India, The Netherlands, Sweden, Costa Rica, and Honduras. The seminar provides students the opportunity to explore and learn about the dynamic linkages between sustainable development, food security, population, the environment, and socio-economic progress from a global perspective. Students across the different sites interact via Internet, satellite, and videoconferencing technologies to analyze a series of interdisciplinary case studies related to global sustainable development. Teams of international students collaborate on a number of projects that are presented during a live videoconference at the end of the semester.

ALS 500 Politics and Policy: Theory, Research, and Practice (also AM ST 501, PAM 406 and GOVT 500)
Students in the College of Agriculture and Life Sciences must register for ALS 500. S. Jackson and staff.
This course, taught in Washington, D.C., forms the core of the public policy option of the Cornell-in-Washington Program. The central course objective is to provide students with the instruction and guidance necessary to analyze and evaluate their own chosen issue in public policy. Toward that end, the course has three components: (1) weekly lectures providing background on the structures and processes of national politics and policy as well as training in research methodology; (2) student externships; and (3) individual research papers or projects. All three components interrelate to provide students with a strategy and framework for integrating classroom-based learning, field experience, and individual research. Applications are made through the Cornell-in-Washington office, 311 Caldwell Hall.

ALS 661 Environmental Policy (also Biology and Society 461 and BIOEE 661)
Fall and spring. 3 credits each term. (Students must register for 6 credits each term since an "R" grade is given at the end of the fall term.) Limited to 12 students. Prerequisite: permission of instructor. Sem R 2:30–4:30 P.M. D. Pimentel.
This course focuses on complex environmental issues. Ten to twelve students, representing several disciplines, investigate significant environmental problems. The research team spends two semesters preparing a scientific report for publication in *Science or BioScience*. Thus far, every study has been published.

AGRICULTURAL AND BIOLOGICAL ENGINEERING

M. F. Walter, chair; B. A. Ahner, L. D. Albright, D. J. Aneshansley, A. J. Baeumner, J. A. Bartsch, J. R. Cooke, A. K. Datta, K. G. Gebremedhin, D. A. Haith, J. B. Hunter, L. H. Irwin, W. J. Jewell, C. D. Montemagno, J.-Y. Parlange, N. R. Scott, T. S. Steenhuis, M. B. Timmons, L. P. Walker; T. J. Cook, L. D. Geohring, P. E. Hillman, lecturers

Note: Class meeting times are accurate at the time of publication. If changes occur, the department will provide new information as soon as possible.

ABEN 102 Introduction to Microcomputer Applications
Fall or spring. 3 credits. S-U grades optional. PC or Mac labs available. All students, including those pre-enrolled, must attend the first lecture to guarantee admittance and to select a laboratory section. Lec, fall: T R 12:20–1:10, spring: M W 12:20–1:10, labs, M 1:25–4:25 or 7:30–10:30 P.M. or T 1:25–4:25 or W 1:25–4:25 or 7:30–10:30 P.M., or R 1:25–4:25 P.M. Fee, $15. P. E. Hillman.
Introduction to application packages on microcomputers. Laboratories provide experience with word processing, spreadsheets, database management, presentation graphics, and web page authoring. An independent project related to the student's major is required. PC or Mac labs cover the same software material. These packages and others such as desktop publishing, multimedia, statistical software, and those used for searching the Internet for information are discussed and demonstrated in the lectures, along with computer hardware and operating systems.

ABEN 110 Introduction to Metal Fabrication Techniques
Spring. 3 credits. Each lab limited to 18 students. Lec, T R 9:05; labs M T or R 1:25–4:25, M or T 7:30–10:30. T. J. Cook.
Emphasis is on selection of proper materials and techniques to accomplish a variety of metal fabrication and maintenance projects. Covers hand and machine tools, fasteners, strengths of materials, classification and identification of metals, soldering, brazing, forging, pipe fitting, sheet metal work, controlling distortion, oxy-acetylene cutting, and arc welding.

ABEN 132 Introduction to Wood Construction
Fall. 3 credits. Each lab limited to 15 students. Lec, T R 9:05; labs, T W or R 1:25–4:25, T or W 7:30–10:30. T. J. Cook.
Principles and practice of wood construction. Covers site selection and preparation, drainage, water and septic development, footers and foundations, material properties, framing and roofing, comparison of alternatives to wood construction, use of hand and power tools, wood joining methods, fasteners, concrete work, and block construction. Each student plans and constructs an approved carpentry project.

ABEN 151 Introduction to Computing
Fall. 4 credits. Lecs, M W F 11:15–12:05; labs, W R 12:20–2:15, 2:30–4:25, F 1:25–2:30. Each lab and recitation section limited to 22 students. L. D. Albright.
An introduction to computer programming and concepts of problem analysis, algorithm development, and data structure in an engineering context. The structured programming language, JAVA, is used, implemented on interactive personal computers, and applied to problems of interest in agricultural and biological engineering. No previous programming experience is assumed.

ABEN 152 Computer Applications for Engineers
Spring. 1–3 credits variable (three 1-credit modules). A student can take any one, any two, or all three modules. Prerequisites: ABEN 151 or equivalent computer programming course and 1 semester of calculus for the Matlab module. No prerequisites for the other two modules. Letter grades only. Lec, T R 2:30–3:20 P.M.; lab M W 1:25–4:25 P.M., or W 7:30–10:30 P.M. P. E. Hillman.
Major application packages useful to engineering and science students are covered in three modules. The first module introduces Matlab and explores the problem-solving

capabilities of Matlab through examples. The second module investigates the data processing and graphing capabilities of spreadsheets. The third module uses presentation graphics and word processing to create effective visual and written documents for professional presentations.

Module 01 Matlab (weeks 1 to 5 of the spring semester)
Covers matrix/vector manipulation, basic math functions, graphing of 2-D and 3-D plots, file I/O, string and numerical manipulation, problem solving of linear and nonlinear algebraic functions and ordinary differential integration, curve fitting, and data analysis and statistics. In lab, students learn Matlab through examples. Grading is based on completion of lab assignments, lecture quizzes, and lecture attendance.

Module 02 Spreadsheets (weeks 6 to 10 of the spring semester)
Covers the use of Microsoft Excel to include built-in functions, lookup tables, graphs, Visual Basic macros, what-if analysis, and advantages and disadvantages compared to a programming language. Grading based on completion of lab assignments, lecture quizzes, and lecture attendance.

Module 03 Presentation tools for the Professional Engineer (weeks 11 to 14 of the spring semester)
Covers the use of Microsoft Word to create a written report and Microsoft PowerPoint to create slides for an oral presentation of engineering projects for professional presentations. Special attention is given to the execution of quality presentations. Grading based on lab assignments, lecture quizzes, lecture participation, and an oral PowerPoint presentation and written report submitted as the final exam.

ABEN 200 The ABEN Experience
Spring. 1 credit. Letter only. Prerequisite: nonmajors by permission of instructor. Lec, T 1:25–2:15. K. M. Overton, J. A. Bartsch.
A required course for freshman majors in Agricultural and Biological Engineering. A forum covering the career opportunities for engineering students and the activities and curricula that lead to these opportunities. A series of seminars are given by practicing engineers, Cornell faculty members, alumni, staff from Cornell career offices, and students. Students develop personalized written career plans, do a web search for jobs and internships, and select future courses to meet their career goals.

ABEN 250 Engineering Applications in Biological Systems (also Engineering Distribution 250)
Fall. 3 credits. Prerequisite: enrollment in an engineering curriculum, MATH 293 (coregistration permissible). Recommended for the sophomore year. Lec, M W F 12:20–1:10. B. A. Ahner.
Case studies of engineering problems in agricultural, biological, and environmental systems, including bioremediation, crop production, environmental controls, energy, biomedicine, and food engineering. Emphasis is on the application of mathematics, physics, and the engineering sciences to energy and mass balances in biological systems.

ABEN 299 Sustainable Development: A Web-Based Course
Spring. 3 credits. Prerequisite: sophomore standing and above. S-U grades optional. N. R. Scott.
Sustainable development is the dominant economic, environmental, and social issue of the twenty-first century. This web-based course develops the concepts of sustainable development as an evolutionary process, demanding the integration of the physical sciences and engineering with the biological and social sciences for design of systems. Topics include the nature of ecosystems, global processes, sustainable communities, and industrial ecology and life cycle analysis.

ABEN 301 Renewable Energy Systems
Spring. 3 credits. Prerequisite: college physics. Lec, T R 10:10–11:25. L. D. Albright.
Introduction to energy systems with emphasis on quantifying costs and designing renewable energy systems to convert environmental inputs into useful forms of energy. Course covers solar energy, small-scale hydropower, wind, bio-conversion processes, house energy balances, and the public policy implications of alternatives. Use of spread sheets is extensive.

ABEN 305 Principles of Navigation (also Nav S 301)
Fall. 4 credits. 4 classes each week (lecture-recitation-project work). Lecs, M W F 8:00–8:50; lab, R 8:00 or 9:05. J.-Y. Parlange.
An introduction to the fundamentals of marine navigation emphasizing piloting and celestial navigation procedures. The course covers coordinate systems, chart projections, navigational aids, instruments, compass observations, time, star identification, use of the nautical almanac, tides and currents. Electronic navigation systems are also *briefly* discussed. This course does not satisfy ABEN technical electives.

ABEN 310 Advanced Metal Fabrication Techniques
Spring. 1 credit (2-credit option available). Prerequisite: ABEN 110 or permission of instructor. Lab, F 1:25–4:30. T. J. Cook.
Principles and practices extending beyond the scope of ABEN 110. Includes out-of-position, high carbon steel and cast iron welding. Topics such as soldering and brazing of aluminum, hard surfacing, both tungsten (TIG) and metallic (MIG) inert gas welding, plasma-arc and oxy cutting of metals are covered. Planning, development, and fabrication of a metal construction project for the two-credit option.

ABEN 350 Biological and Environmental Transport Processes
Fall. 3 credits. Prerequisites: MATH 294 and fluid mechanics (co-registration permissible). Lecs, M W F 11:15–12:05; disc, W 2:30–3:20. 2 evening prelims. K. G. Gebremedhin.
Focus is on understanding the principles of heat and mass transfer in the context of biological and environmental systems. Physical understanding of transport processes and simple reaction rates with application examples from plant, animal and human biology, the environment (soil/water/air), and industrial processing of food and biomaterials are emphasized.

ABEN 365 Properties of Biological Materials
Spring. 3 credits. Prerequisites: ENGRD 202 (coregistration permissible). Lec, T R 12:20–1:10; lab W 2:30–4:25, R 2:30–4:25, or F 2:30–4:25. J. A. Bartsch.
Mechanics and structural properties of biological materials. Mechanical testing of animal, plant, and food products. Laboratory exercises in quasi-static and dynamic testing of materials and interpretation of test results. Experimental techniques for determining engineering properties of these materials. This course satisfies the ABEN laboratory exeprience requirement.

ABEN 371 Hydrology and the Environment
Spring. 3 credits. Prerequisite: one course in calculus. 2 lecs, 1 lab. Lecs, T R 9:05–9:55; lab, F 2:30–4:25. T. S. Steenhuis, B. Richards.
Introduction to hydrology: the hydrologic cycle and the role of water and chemicals in the natural environment. Includes precipitation, infiltration, evaportranspiration, ground water, surface runoff, river meandering, floods, and droughts. Case studies, short field trips, and laboratories foster an understanding of concepts and principles of hydrologic processes.

[ABEN 411 Biomass Processing: Modeling and Analysis
Spring. 3 credits. Prerequisites: ABEN 250; ABEN 350 (or any course in heat and mass transport); BIOBM 331, 332, or BIOMI 290. Lec, M W F 9:05–9:55. Not offered 2001–2002. Next offered spring 2003. L. P. Walker.
This course is designed to introduce students to how basic concepts from physical chemistry, enzyme and microbial kinetics, and transport phenomena are used to model biomass conversion and degradation processes. Examples of different agricultural and environmental processes are used to explore model development, solutions, and validation. Strong emphasis on the use of differential equations to model process dynamics.]

ABEN 425 Science and Technology of Environmental Management
Fall. 3 credits. Prerequisite: senior and graduate students only. Letter only. Lec, T R 2:55–4:10. W. J. Jewell.
Quantitative description of decline in environmental quality caused by human activities, and exploration of science and technology solutions to pollution and their limits. Tools used by engineers and scientists to understand the environment are used to focus on water quality problems (two-thirds), air quality (one-sixth), and land quality (one-sixth).

ABEN 427 Water Sampling and Measurement
Fall. 3 credits. Prerequisites: fluids or a hydrology course and MATH 191. Lec, T 9:05–9:55; lab, T 1:25–4:25. L. D. Geohring and T. S. Steenhuis.
Get your feet wet and your hands busy with this course on water sampling methods where science and engineering technologies are integrated to quantify, characterize, and analyze environmental engineering problems. This field-based laboratory course focuses on quantification of surface and subsurface flow and quality, and includes sampling techniques of soils, sediment, and biological waste products. Quality assurance and control protocols and interpretation of watershed loading of contaminants are addressed. This course satisfies the ABEN laboratory exeprience requirement.

ABEN 435 Principles of Aquaculture
Spring. 3 credits. Prerequisite: must be at least a junior. Lec, W 1:25–4:25. M. B. Timmons.
An in-depth treatment of the principles of aquaculture: fish biology, waste treatment, engineering design, fish health, nutrition, processing, and so on. This course is intended to build upon the undergraduate's previous course background and interests. Includes supervised "hands-on" laboratory experiences.

ABEN 436 Aquaculture Using Recirculating Water Reuse Technology
Spring. 1 credit. Prerequisite: ABEN 435 (co-registration permissible). Lab, R 2:25–4:25. M. B. Timmons.
The course focuses on actual fish culture using water reuse technology. Course begins **after** spring break. Requires daily care of animals and performing water chemistry management. Team report required. Intended to complement ABEN 435 as a "hands-on" learning experience.

ABEN 450 Bioinstrumentation
Spring. 4 credits. Prerequisites: MATH 294, ABEN 151, PHYS 213, or permission of instructor. Lec, M W 8:40–9:50; lab, M or W 2:30–4:25. D. Aneshansley.
Biological and biomedical applications are emphasized in this laboratory-based course. The electronic instrument from sensor to computer is considered. Static and dynamic characteristics of components and systems are determined theoretically and empirically. General analog and digital signal condition circuits are designed, constructed, and tested. This course satisfies the ABEN capstone design requirement.

ABEN 453 Computer-Aided Engineering: Applications to Biomedical and Food Processes (also M&AE 453)
Spring. 3 credits. Prerequisite: computer programming (ABEN 151 or CS 100) and heat and mass transfer (ABEN 350 or equivalent). Lecs, M W 11:15–12:05; computation disc/lab: F 11:15. A. K. Datta.
Introduction to simulation-based design as an alternative to prototype-based design. Analysis and optimization of complex real-life processes using an industry-standard physics-based computational software on a supercomputer or on high end personal computers. Biomedical processes and industrial food processing applications of heat and mass transfer are covered. Computational topics introduce the finite-element method, pre- and post-processing, and pitfalls of using computational software. Students choose their own term project, which is the major component of the course (no final exam). The course satisfies the College of Engineering upper-level computing application requirement. This course satisfies the ABEN capstone design requirement.

ABEN 454 Physiological Engineering
Fall. 3 credits. Corequisite: fluid mechanics. Lecs, T R 12:20–1:10; lab T R 1:25–4:25. D. J. Aneshansley.
Engineering analysis and design in the physiology of animals and humans. Covers the use of engineering principles to study how animals work in nature and to intervene in physiological functions. The two major engineering themes are: signal processing as related to neural conduction, sound processing, vision, and image processing; and systematics as applied to cardiovascular and respiratory systems, bioenergetics, and bird flight. Laboratories involve experiments, computing applications, field trips, and live animal demonstrations. This course satisfies the ABEN laboratory experience requirement.

ABEN 456 Biomechanics of Plants (also BIO PL 456)
Fall. 3 credits. Prerequisites: upper division undergraduate or graduate status, completion of introductory sequence in biology and one year of calculus, or permission of instructor. S-U or letter grade optional. Lec, T R 11:15–12:05; disc, W 2:30–3:20. J. R. Cooke and K. J. Niklas.
An engineering approach is taken to plant form and function following the text, *Plant Biomechanics*. Topics include: mechanical behavior of materials, effect of geometry on mechanical behavior, plant-water relations, plant cell walls, mechanical behavior of tissues, mechanical attributes of organs, the plant body, fluid mechanics and biomechanics, and plant evolution.

ABEN 458 Biotechnology: Principles and Application in Engineering
Fall. 4 credits. Prerequisites: ABEN 350 (co-registration allowed), biochemistry, microbiology, fluid mechanics, or permission of instructor. Lecs, T R 8:40–9:55; lab 1:25–4:25 and 7:30–10:30 (students must attend both lab sections). A. J. Baeumner.
This course provides students with an understanding of the scientific and engineering principles of biotechnology and their applications in agriculture, environmental and consumer protection, manufacturing, and processing. Topics include microbial synthesis, production and degradation, genetic engineering, immobilization, biosensor techniques, up- and down-stream processing, and fermentation techniques. This course satisfies both the ABEN laboratory experience and the ABEN capstone design requirement.

ABEN 471 Geohydrology (also CEE 431 and EAS 445)
Fall. 3 credits. Prerequisites: Mathematics 294 and Engr 202. 2 lecs, 1 disc, lecture, field trip. W. Brutsaert, L. M. Cathles, J.-Y. Parlange, T. S. Steenhuis.
Intermediate-level study of aquifer geology, groundwater flow, and related design factors. Includes description and properties of natural aquifers, groundwater hydraulics, soil water, and solute transport.

ABEN 473 Watershed Engineering
Fall. 3 credits. Prerequisite: fluid mechanics or hydrology. Lecs, T R 10:10–11:00; disc, R 1:25–4:30. M. F. Walter.
Engineering principles are applied to the design of soil and water management technologies aimed at solving natural resource problems in the context of watersheds. Emphasis is placed on rural and countryside engineering and small-scale design for water conveyance, soil erosion control, flood damage control, earthen dams, ponds, moisture conservation, drainage, and water supply. ABEN students who wish to take this course to satisfy the ABEN capstone design requirement, must co-register in ABEN 496 for one credit hour. This course satisfies the College of Engineering technical writing requirement when co-registered in ABEN 493.

ABEN 474 Drainage and Irrigation Design
Spring. 3 credits. Prerequisites: fluid mechanics or hydrology. Lecs, M W F 12:20–1:10. T. S. Steenhuis and L. D. Geohring.
This course will focus on design of drainage and irrigation systems for agriculture and nonagricultural purposes. The course will also briefly cover design for rural water supply and sanitation systems. Emphasis is placed on problem solving with actual situations used wherever possible. One major design project is required of each student. This course satisfies the ABEN capstone design requirement.

ABEN 475 Environmental Systems Analysis
Spring. 3 credits. Prerequisites: Matlab and 2 years of calculus. Lecs, M W F 10:10–11:00. L. P. Walker.
Systems analysis and its use in environmental quality management. Emphasis is on modeling of environmental problems, translation of models into efficient computational algorithms, and use of computer simulation and optimization procedures (search techniques, linear programming, and dynamic programming) to evaluate management alternatives. Applications include water quality management, air pollution control, solid waste management, and industrial ecology. This course satisfies the College of Engineering upper-level computing application requirement.

ABEN 476 Solid Waste Engineering
Spring. 3 credits. Prerequisites: 1 semester of physics and chemistry. Lecs, T R 11:40–12:55. D. A. Haith.
Planning and design of processes and facilities for management of municipal solid wastes. Source characterization and reduction; collection and transport systems; waste-to-energy combustion; sanitary landfills; composting; recycling and materials recovery facilities; and hazardous waste management. Emphasis is on quantitative analyses.

ABEN 478 Ecological Engineering
Spring. 3 credits. Prerequisite: junior-level environmental quality engineering course or equivalent. Lecs, T R 2:30–3:45. W. J. Jewell.
Natural waste treatment systems are sustainable, driven by solar power, and generate useful and valuable by-products. Constructed wetlands, hydroponic applications of plants, wastewater farming, sludge and industrial residue application to land, soil restoration, bioremediation of toxics, and biofilters for air purification are examples of pollution control systems that depend on natural processes. Pollution control mechanisms in soils and plants are defined and used to design innovative treatment systems for agriculture, municipalities, and industry. ABEN students who wish to take this course to satisfy the ABEN capstone design requirement must co-register in ABEN 496 for one credit hour.

ABEN 481 LRFD-Based Engineering of Wood Structures (also CEE 481)
Spring. 3 credits. Prerequisite: ENG 202. Lecs, M W F 12:20–1:10 (Hollister Hall). K. G. Gebremedhin. Two evening prelims.
Computer-aided and manual computation procedures of Load and Resistance Factor Design (LRFD)–based engineering of wood structures. Topics include national design codes and standards; estimation of design loads (dead, live, wind, snow, and seismic

loads); determination of factored resistance and stiffness values; mechanical properties of wood and wood products; designs of beams, columns, trusses, frames, arches, bridges, and diaphragms; connections and special wood structural members and systems. Engineering design judgment is also discussed as an integral component of the quantitative design procedure. ABEN students who wish to take the course to satisfy the ABEN capstone design requirement must co-register in ABEN 496 for one credit hour.

ABEN 482 Biothermal Engineering
Spring. 3 credits. Prerequisites: ABEN 250 and 350, or equivalent. Lecs, T R 11:15–12:05; lab, W 1:25–4:25. N. R. Scott.
Analysis and design of the thermal and aerial environments of plants, animals, and humans. Thermal environmental requirements dictate the design of buildings to act as buffers between biological systems and weather. Heat flow, air flow, psychrometrics, energy balances, thermal biology, animal and plant models, thermal modeling, mechanical and natural ventilation, solar energy, and weather phenomena. This course satisfies the capstone design experience requirement.

ABEN 489 Engineering Entrepreneurship, Management and Ethics
Spring. 3 credits. Prerequisites: ENGRD 270 or CEE 304 or equivalent, junior standing. Lec, T R 1:25–2:40; lab, one overnight field trip during semester. M. B. Timmons.
The course focuses on Engineering Economics, Engineering Management and Professional Ethics, and associated ethical issues. Course objectives include coverage of: prediction/probability of net returns; financial calculations (internal rate of return, time value of money, proforma statements); legal structures of businesses; project management; develop an awareness of issues related to professional ethics; and technical writing and communication. This course satisfies the College of Engineering technical writing reqiuirement.

ABEN 493 Technical Writing for Engineers
Fall. 1 credit. Prerequisites: co-registration with ABEN 473. Lec, M 7:30–9:25 (5 evenings in first half of semester). Staff.
This course meets the College of Engineering technical writing requirement when taken concurrently with ABEN 473. Class meets for five evening sessions during the fall semester and covers writing skills necessary for technical project reports. Also considered: outlines, style, audience, and general writing mechanics.

ABEN 494 Special Topics in Agricultural and Biological Engineering
Fall or spring. 4 credits maximum. S-U grades optional. Staff.
The department teaches "trial" courses under this number. Offerings vary by semester and are advertised by the department. Courses offered under the number will be approved by the department curriculum committee, and the same course is not offered more than twice under this number.

ABEN 495 ABEN Honors Research
Fall or spring. 1–6 variable credits. Prerequisite: enrollment in the ABEN Honors Research program. Letter grade. Staff.
Intended for students pursuing the Research Honors program in ABEN. Students must complete the Honors program application by the 3rd week of the fall semester senior year.

ABEN 496 Capstone Design in Agricultural and Biological Engineering
Fall and spring. 1 credit. Corequisite: students must co-register in one of the approved upper level courses (ABEN 473, 478, 481). Students must register with an independent study form (available in 140 Roberts Hall). Staff.
Involves capstone design experience, including a team project incorporating analysis, design, evaluation, synthesis, and a written report of the end-product. This course must be taken in conjunction with one of the following approved ABEN courses (ABEN 473, 478, 481).

ABEN 497 Individual Study in Agricultural and Biological Engineering
Fall and spring. 1–4 credits. S-U option. Prerequisite: written permission of instructor and adequate ability and training for the work proposed. Normally reserved for seniors in the upper two-fifths of their class. Students must register with an independent study form (available in 140 Roberts Hall). Staff.
Special work in any area of agricultural and biological engineering on problems under investigation by the department or of special interest to the student, provided, in the latter case, that adequate facilities can be obtained.

ABEN 498 Undergraduate Teaching
Fall and spring. 1–4 credits. Prerequisite: written permission of instructor. Students must register with an independent study form (available in 140 Roberts Hall). Staff.
The student assists in teaching an agricultural and biological engineering course appropriate to his/her previous training. The student meets with a discussion or laboratory section, prepares course materials, grades assignments, and regularly discusses objectives and techniques with the faculty member in charge of the course.

ABEN 499 Undergraduate Research
Fall and spring. 1–3 credits. Prerequisites: normally reserved for seniors in the upper two-fifths of their class; adequate training for work proposed; and written permission of instructor. Students must register with an independent study form (available in 140 Roberts Hall). Staff.
Research in any area of agricultural or biological engineering on problems under investigation by the department or of special interest to the student, provided that adequate facilities can be obtained. The student must review pertinent literature, prepare a project outline, carry out an approved plan, and submit a formal final report.

ABEN 501–502 M.P.S. Project
Fall and spring. 1–6 credits. Required of each M.P.S. candidate in the field. Hours TBA. ABEN graduate faculty.
A comprehensive project emphasizing the application of agricultural technology to the solution of a real problem.

ABEN 551–552 Agricultural and Biological Engineering Design Project
Fall and spring. 3–6 credits. Prerequisite: admission to the M.Eng. (ABEN) degree program. ABEN graduate faculty.
Comprehensive design projects dealing with existing engineering problems in the field. Emphasis is on the formulation of alternative design proposals that include consideration of economics, nontechnical factors, engineering analysis, and complete design for the best design solution. Projects are supervised by faculty members on an individual basis. There, however, is a formal orientation during the first four weeks of the semester. A formal report and public presentation of the results of the design project are required for completion of the course(s). A minimum of 3 to a maximum of 12 credits of 551–552 is required for the Master of Engineering degree. Students should register for 551 their first semester and complete any additional design project credits with 552. If more than six design project credits are desired in one semester, both 551 and 552 may be taken.

ABEN 651 Bioremediation: Engineering Organisms to Clean Up the Environment
Spring. 3 credits. Prerequisites: BIOMI 290 or BIOMI 398 or BIOBM 331 or permission of instructor. Lec T R 10:10–11:00. B. Ahner.
This course examines ways in which organisms may be used to remove or metabolize pollutants in the environment including bacterial degradation of organics and phytoremediation of heavy metals. Through lectures and current literature, students evaluate the benefits as well as the current obstacles. The current efforts to genetically engineer organisms for bioremediation and the potential risks of releasing them into the environment are examined.

ABEN 652 Instrumentation: Sensors and Transducers
Spring. 3 credits. Prerequisites: linear differential equations, introductory chemistry and introductory physics, or permission of the instructor. Lec T R 12:20–1:10; lab 2:00–4:25. D. J. Aneshanley.
Application of instrumentation concepts and systems to the measurement of environmental, biological, and agricultural phenomena. Construction and characterization of electronic sensors and transducers is emphasized. Image processing techniques are introduced. A final project is required.

[ABEN 655 Thermodynamics and Its Applications
Spring. 3 credits. Prerequisite: Mathematics 293 or equivalent. Lecs, R 2:30–4:30. Not offered 2001–2002. J.-Y. Parlange.
Thermodynamics and its applications to problems in engineering and agriculture. Topics include basic concepts (equilibrium, entropy, processes, systems, potentials, stability, phase transitions) and applications (soil and water processes, dilute solutions, electromagnetism, surface phenomena, heat and mass transport, and structure of organizations).]

ABEN 658 Biosensors and Bioanalytical Techniques
Spring. 4 credits. Prerequisites: biochemistry and permission of instructor. Lecs, T R 8:40–9:55; lab, M 1:25–4:25. A. J. Baeumner.
This course provides students with an understanding of the scientific and engineering principles of biosensors and bioanalytical techniques. The course addresses selected topics from simple biosensors to micro/nanofabricated microTotal Analysis Systems. Their application in environmental analysis,

food safety, and medical diagnostic is explored. Students take an active part in the course, prepare a biosensor of their choice in the laboratory, and present its concept in a biosensor workshop at the end of the semester.

[ABEN 671 Analysis of the Flow of Water and Chemicals in Soils
Fall. 3 credits. Prerequisites: four calculus courses and fluid mechanics. Lec, R 3:35–4:50 (first meeting—TBA after that). Not offered 2001–2002. J.-Y. Parlange.
The course encompasses a full range from simple to complex methods to describe the chemical and water flows on the surface, in the vadose zone, and through the aquifer. Current analytical, semi-analytical, and computer-based techniques are discussed. Both homogeneous and heterogeneous soils are analyzed. Offered alternately with Civil and Environmental Engineering 633—a complementary, but not identical, course.]

ABEN 672 Drainage
Spring. 4 credits. Prerequisites: ABEN 471 or ABEN 473. S-U grades optional. Lecs, M W F 12:20–1:10; lab, T 1:25–4:25. T. S. Steenhuis and L. D. Geohring.
Theory of water and solute flow in aquifers, hillslopes, and the vadose zone as it relates to artificial drainage is discussed. Drainage design as it relates to agricultural land, landfills, and land application sites is critically reviewed. The importance of preferential flow and matrix flow on water quality of drainage waters is examined. Laboratories are used for hands-on experience with measuring soil parameters and for actual drainage design. This course satisfies the capstone design experience requirement.

ABEN 673 Sustainable Development Seminar (also NBA 573)
Spring. 1–3 credits. Prerequisites: upper division undergraduate and graduate students or permission of instructor. Lec, F 1:30–3:30. N. R. Scott.
Sustainable development is the most beneficial concept to come out of the environmental movement in years. The concept of a sustainable world, however, is not a constant. There are many aspects of sustainability involving economics, environment, and political, social, scientific, and technological developments. This seminar explores topics such as energy, agricultural and food systems, green buildings and ecological design, corporate sustainability, and other contemporary issues.

ABEN 678 Nonpoint Source Models
Spring. 3 credits. Prerequisites: computer programming and calculus. Lecs, T R 8:40–9:55. D. A. Haith.
Development and programming of simulation models for management of water pollution from runoff and percolation. Emphasis is on prediction of water and chemical inputs to surface waters and groundwater. Applications include watershed hydrology and sediment yield, urban and rural runoff, lake eutrophication, waste disposal sites, and pesticides, nutrients, and salts in drainage.

ABEN 685 Biological Engineering Analysis
Spring. 4 credits. Prerequisite: T&AM 310 or permission of instructor. Lecs, M W F 11:15–12:05. J. R. Cooke.
Engineering problem-solving strategies and techniques are explored. Students solve several representative engineering problems that inherently involve biological properties. Emphasis is on formulation and solution of mathematical models and the interpretation of results. The student's knowledge of fundamental principles is used extensively.

ABEN 694 Graduate Special Topics in Agricultural and Biological Engineering
Fall or spring. 4 credits maximum. S-U grades optional. ABEN graduate faculty.
The department teaches "trial" courses under this number. Offerings vary by semester, and are advertised by the department. Courses offered under the number will be approved by the department curriculum committee, and the same course is not offered more than twice under this number.

ABEN 697 Graduate Individual Study in Agricultural and Biological Engineering
Fall or spring. 1–6 credits. Prerequisite: permission of instructor. S-U grades optional. ABEN graduate faculty.
Topics are arranged by the staff at the beginning of the term.

ABEN 700 General Seminar
Fall. 1 credit. S-U grades only. Staff.
Presentation and discussion of research and special developments in agricultural and biological engineering and related fields.

ABEN 750 Orientation to Graduate Study
Fall. 1 credit. Limited to new graduate students. S-U grades only. Lecs, first 7 weeks, M 3:35–4:25; remainder to be arranged. D. J. Aneshansley.
An introduction to ABEN research policy, programs, methodology, resources, and degree candidates' responsibilities and opportunities.

ABEN 754 Watershed Management
Spring. 2–3 credits. Prerequisite: graduate standing or permission of instructors. Lec, W 2:30–4:25. T. S. Steenhuis and M. J. Pfeffer.
Traditional top-down approaches to watershed management have been challenged by advocates of public participation. These challenges have raised questions about how to effectively integrate science, policy, and public participation. This course reviews different management approaches and evaluates their usefulness in dealing with different watershed management problems. Case examples from watersheds in the United States and overseas are considered.

ABEN 771 Soil and Water Engineering Seminar
Fall and spring. 1–3 credits. Prerequisite: graduate status or permission of instructor. S-U grades optional. Hours TBA. T. S. Steenhuis, J.-Y. Parlange, and M. F. Walter.
Study and discussion of research or design procedures related to selected topics in irrigation, drainage, erosion control, hydrology, and water quality.

ABEN 781 Structures and Related Topics Seminar
Spring. 1 credit. Prerequisite: graduate status or permission of instructor. S-U grades only. TBA. Staff.
Advanced analysis and design of production systems with emphasis on structural and environmental requirements, biological responses, and economic considerations.

ABEN 785 Biological Engineering Seminar
Spring. 1 credit. Prerequisite: graduate status or permission of instructor. S-U grades only. J. R. Cooke.
The interactions of engineering and biology, especially the environmental aspects of plant, animal, and human physiology, are examined in order to improve communication between engineers and biologists.

ABEN 800 Master's-Level Thesis Research
Fall and spring. 1–15 credits. Prerequisite: permission of adviser. S-U grades. ABEN graduate faculty.

ABEN 900 Doctoral-Level Thesis Research
Fall and spring. 1–15 credits. Prerequisite: permission of adviser. S-U grades. ABEN graduate faculty. Variable credit for Ph.D. research.

APPLIED ECONOMICS AND MANAGEMENT

A. M. Novakovic, chair; D. J. Allee, B. L. Anderson, C. B. Barrett, N. L. Bills, R. N. Boisvert, L. D. Chapman, N. H. Chau, R. D. Christy, J. M. Conrad, R. T. Curtis, H. de Gorter, G. A. German, B. A. Gloy, D. A. Grossman, J. M. Hagen, H. M. Kaiser, S. M. Kanbur, W. A. Knoblauch, S. C. Kyle, E. L. LaDue, D. R. Lee, W. H. Lesser, E. W. McLaughlin, M. G. Meloy, R. A. Milligan, T. D. Mount, T. Ng, P. D. Perez, D. J. Perosio, G. L. Poe, J. E. Pratt, C. K. Ranney, W. D. Schulze, D. Simon, M. W. Stephenson, D. H. Streeter, L. W. Tauer, W. G. Tomek, C. L. van Es, S. Wang, G. B. White

Courses by Subject

Farm management, agricultural finance, and production economics: 302, 403, 404, 405, 605, 608, 708

Statistics, quantitative methods, and analytical economics: 210, 410, 411, 412, 415, 416, 417, 710, 711, 712, 713, 714, 717

Management, finance, law, and accounting: 220, 221, 320, 321, 323, 324, 325, 326, 328, 329, 420, 422, 424, 425, 426, 427, 429

Policy and International Trade: 230, 430, 431, 432, 433, 434, 630, 632, 633, 634, 730, 735

Marketing and food distribution: 240, 241, 340, 344, 346, 347, 443, 446, 447, 448, 449, 640, 641, 740

Environmental and resource economics: 250, 450, 451, 555, 651, 652, 655, 750, 751

Economics of development: 464, 660, 665, 666, 667, 762, 763

Consumer economics: 670

General, contemporary issues, research, and other: 101, 380, 494, 497, 498, 499, 694, 698, 699, 700, 800, 900, 901

SPECIAL NOTE: The department formally known as Agricultural, Resource, and Managerial Economics (ARME) is changing its name to the department of Applied Economics and Management (AEM). Courses cross-listed as ARME can be found here. Courses with the same number listed as either ARME or AEM, are identical.

Note: Class meeting times are accurate at the time of publication. If changes are necessary, the department will provide new information as soon as possible.

AEM (ARME) 101 Introduction to Applied Economics and Management
Fall. 1 credit. Required of and limited to freshmen in Applied Economics and Management. S-U grades only. Lec, W 11:15–12:05. M. J. Hubbert.
An introduction to the various specialized programs of study within the Department of Applied Economics and Management. Numerous faculty members from the AEM Department will participate. Team work and group interaction are emphasized.

AEM (ARME) 210 Introductory Statistics
Fall. 4 credits. Prerequisite: EDUC 115 or equivalent level of algebra. Lecs, M W F 11:15–12:05; secs, M 7:30–9:25 P.M.; T 10:10–12:05, 12:20–2:15 (2 secs), or 2:30–4:25 (2 secs); W 12:20–2:15 (2 secs), 2:30–4:25, or 7:30–9:25 P.M.; R 12:20–2:15 (2 secs), 2:30–4:25 (2 secs), or F 12:20–2:15 (2 secs). 2 evening prelims. C. van Es.
An introduction to statistical methods. Topics covered include the descriptive analysis of data, probability concepts and distributions, estimation and hypothesis testing, regression, and correlation analysis. Applications from business, economics, and the biological sciences are used to illustrate the methods covered in the course.

AEM (ARME) 220 Introduction to Business Management
Spring. 3 credits. Enrollment limited to AEM majors and those in the process of transferring to the major. Preference given to other CALS majors. Additional enrollment as capacity permits, with permission of the instructor. 2 evening prelims. Lecs, M W F 10:10–11:00. P. D. Perez.
This course provides an overview of management and business. Human resources, marketing, finance, and strategy concerns are addressed with consideration paid to current issues such as globalization, ethics, quality, and strategic alliances. Case studies and guest executives are an important part of the course.

AEM (ARME) 221 Financial Accounting
Spring. 3 credits. Not open to freshmen. Priority given to CALS majors. Lecs, M F 11:15–12:05 or 12:20–1:10; sec, T 10:10–12:05 (2 secs), 12:20–2:15 (2 secs), or 2:30–4:25; W 10:10–12:05, 12:20–2:15 (3 secs), 2:30–4:25 (2 secs), or 7:30–9:25 P.M.; or R 10:10–12:05, 12:20–2:15, or 2:30–4:25. 2 evening prelims and a comprehensive final; weekly homework assignments; one written case study; and one project using an electronic spreadsheet. Staff.
A comprehensive introduction to financial accounting concepts and techniques, intended to provide a basic understanding of the accounting cycle, elements of financial statements, underlying theory of GAAP, and statements interpretation. Elements examined include inventory, depreciation, internal control of assets, time value of money, notes, stocks, bonds, and the statement of cash flows. Limited use of a financial data base of publicly held companies; introduction to financial information on the web.

AEM (ARME) 230 International Trade and Finance (also ECON 230)
Spring. 3 credits. Prerequisites: ECON 101 or equivalent required; ECON 102 or equivalent recommended. Lecs, T R 1:25–2:40; sec, M 2:30–3:20, 3:35–4:25, or 7:30–8:20 P.M.; T 3:35–4:25; or W 2:30–3:20, 3:35–4:25, or 7:30–8:20 P.M. 1 evening prelim. D. R. Lee.
This course provides a one-semester introduction to international economics principles and issues. The course first surveys key topics such as the elements of comparative advantage, tariff and non-tariff barriers, and multilateral institutions. The second part of the course treats selected topics in international finance, including exchange rates, balance of payments, and capital markets. Current issues such as the effects of trade liberalization, trade and economic growth, and instability in international capital markets are discussed throughout. This course is designed as a less technical introduction to concepts developed at a more advanced level in AEM (ARME) 430 and ECON 361–362.

AEM (ARME) 240 Marketing
Fall. 3 credits. Enrollment limited to AEM majors and those in the process of transferring to the major. Preference given to other CALS majors. Additional enrollment as capacity permits, with permission of the instructor. No adds after first week of class. Lecs, M W F 10:10–11. M. G. Meloy.
This course provides a broad introduction to the fundamentals of marketing. The components of an organization's strategic marketing program, including how to price, promote, and distribute goods and services to people are explored. Industry guest lectures and current marketing applications from various companies are presented and analyzed. Concurrent enrollment in AEM 241 is required for AEM majors and recommended for those considering transferring to AEM.

AEM (ARME) 241 Marketing Plan Development
Fall. 1 credit. Prerequisites: concurrent enrollment in AEM 240. Rquired of and limited to AEM majors enrolled in AEM 240; others by permission of instructor. Lecs, W 7:30–8:20 P.M. L. A. Robinson.
The course offers students, working in teams, the opportunity for an intense, hands-on application of basic marketing concepts through research and development of a marketing plan. Guided by a series of assignments, teams develop key components that are integrated into a comprehensive written plan for a local not-for-profit organization. A PowerPoint-based oral presentation of the plan is also required. All AEM majors registered in AEM 240 are required to take AEM 241. Additional students are accommodated on a space available basis with permission of the instructor. Assignments are closely coordinated with both the content and sequencing of material being presented in AEM 240.

AEM (ARME) 250 Environmental and Resource Economics
Spring. 3 credits. T R 11:40–12:55. S-U grades optional. G. L. Poe.
An introduction to the economic ocncepts and methods usedin the private and public analysis of how society uses and impacts its environmental resources. Subjects include valuation, benefit-cost analysis, policy design, property rights, and ecological economics. These tools are used to explore major current policy issues such as economic incentives in environmental policy, endangered species protection, air and water pollution, depletion of renewable and non-renewable resources, global warming, the growing world trade in resource intensive manufactured products and the impact on income, employment, pollution, and comparative resource use and environmental protection in industrialized and developing countries.

AEM (ARME) 302 Farm Business Management
Fall. 4 credits. Not open to freshmen. This course is a prerequisite for AEM 405 and 427. Lecs, M W F 9:05–9:55; sec, W or R 1:25–4:25. On days farms are visited, the section period is 1:25–6:00. W. A. Knoblauch.
An intensive study of planning, directing, organizing, and controlling a farm business, with emphasis on the tools of managerial analysis and decision making. Topics include financial statements, business analysis, budgeting, and acquisition, organization, and management of capital, labor, land, buildings, and machinery.

AEM (ARME) 320 Business Law I (also NBA 560)
Fall. 3 credits. Limited to juniors, seniors, and graduate students. Lecs, M W F 9:05–9:55. 1 evening prelim. D. A. Grossman.
Consideration is given chiefly to legal problems of particular interest to persons who expect to engage in business. Emphasis is on the law pertaining to contracts, sales, agency, and property.

AEM (ARME) 321 Business Law II (also NBA 561)
Spring. 3 credits. Limited to juniors, seniors, and graduate students. Prerequisite: a course in business law or permission of instructor. Lecs, T R 8:40–9:55. D. A. Grossman.
The first portion of this course examines legal issues in the formation and operation of business enterprises, particularly partnerships, corporations, and limited liability companies. The second portion of the course reviews selected topics in business law, like employment discrimination, debtor/creditor relations, product liability, unfair competition, e-commerce law, and international business law.

AEM (ARME) 323 Managerial Accounting
Fall. 3 credits. Priority given to CALS majors. Prerequisite: AEM (ARME) 221 or equivalent. Lecs, M W 12:20–1:10; secs, R 10:10–12:05 (2 secs), 12:20–2:15 (3 secs), or 2:30–4:25 (3 secs); or F 10:10–12:05 or 12:20–2:15 (3 secs). 2 evening prelims, a third exam, weekly homework, one written case study, and one project using an electronic spreadsheet. Staff.
An introduction to cost accounting that emphasizes the application of accounting concepts to managerial control and decision making. Major topics include product costing, standard costing, cost behavior, cost allocation, budgeting, inventory control, variance analysis, measuring divisional performance, and accounting systems in the manufacturing environment. Use of electronic spreadsheets is required.

AEM (ARME) 324 Financial Management
Spring. 4 credits. Priority given to CALS majors. Prerequisite: AEM (ARME) 220 or equivalent. Recommended: AEM (ARME) 210 and 221 or equivalents. Lecs, T R 2:55–4:10; secs, W 12:20–2:15, 2:30–4:25 or 7:30–9:25 P.M. or F 10:10–12:05, 12:20–2:15, or 2:30–4:25. 3 evening prelims. R. Curtis.

This course focuses on basic managerial, financial, and economic decisions, corporate financial policy, risk management, and investments. Topics include the time value of money, capital budgeting decisions, financing alternatives, short-term financial policy, the cost of capital and the capital structure decision, distribution policy, mergers and acquisitions, options, forward and futures contracts, market efficiency and market anomalies, and personal financial considerations.

AEM (ARME) 325 Personal Enterprise and Small Business Management
Spring. 4 credits. Limited to juniors and seniors. Prerequisites: AEM (ARME) 220 and 221 or permission of instructor. Absolutely no adds or drops after second class meeting. Term project work will amount to approximately $100 per team. Lecs, T R 12:20–1:10; sec, W 2:30–4:25. Two additional hours to be arranged. D. Streeter.
Course is focused on the activities involved in planning a start-up business, including the exploration of strategic dimensions, performance of marketing research, and planning of financial aspects related to the new company. Lectures and hands-on clinics include visits by real world entrepreneurs who discuss the start-up process and the challenges of managing growth in a small business. Term project is the development of a business plan, completed in teams of no fewer than three students.

AEM (ARME) 326 Human Resource Management in Small Businesses
Fall. 3 credits. Prerequisite: AEM (ARME) 220 or AEM (ARME) 302 or equivalent. S-U grades optional. Lecs, T R 10:10–11:25 or 11:40–12:55 or 2:55–4:10. 1 evening prelim. R. A. Milligan.
An introduction to the management of human resources in small businesses. The focus is on developing and using all of the capabilities of all small business personnel including owners, family members, and employees. Topics include people-oriented management, alignment, coaching, evaluation, recruitment, selection, compensation, training, empowerment, team building, leadership, performance management, and conflict resolution. Student involvement and active learning experiences are emphasized.

AEM (ARME) 328 Innovation and Dynamic Management (also H ADM 418)
Spring. 3 credits. Limited to juniors and seniors. Lecs, T R 1:25–2:40. C. Enz.
For description, see H ADM 418.

AEM (ARME) 329 Global Agribusiness Management
Spring. 1 credit. Prerequisites: AEM (ARME) 220 or AEM (ARME) 302, and AEM (ARME) 240. There is a 2-credit study trip that is available to 10–15 students (instructor permission necessary). Students complete an independent study for the 2 credits the following fall term. Cost of the study trip is $800 per student (some scholarship support is available). Lecs, W 10:10–11:00. B. A. Gloy and B. L. Anderson.
The general purpose of this course is to provide students interested in agribusiness management exposure to the managerial practices essential to the success of agriculture, agribusiness, and food companies competing in the global marketplace. Students are exposed to foreign and international U.S. firms and industries. A term paper is required. During the fifth week of the course 10–15 students are selected to participate in a two-credit, two-and-a-half week international study trip that occurs after the end of the semester. Preference is given to sophomores and juniors in the College of Agriculture and Life Sciences. An additional term paper will be required for the international field study. Preference is given to students with a demonstrated career interest in agribusiness. Students selected for the study trip enroll in a 2-credit independent study course (AEM 497) in the following fall semester.

AEM (ARME) 340 Futures and Options Trading
Spring. 3 credits. Limited to juniors and seniors. Priority given to CALS juniors and seniors, then out of college seniors. Prerequisites: ECON 101, EDUC 115, and AEM (ARME) 210 or equivalent. S-U grades optional. Lecs, T R 10:10–11:25. W. H. Lesser.
The focus of the course is on the use of futures and options as risk management tools. Commodities, exchange rate, and interest rate derivatives are covered from the perspective of the hedger, but those interested in arbitrage and speculation are provided some insights as well. Students participate in a simulated trading exercise in which they use price and market information and input from industry experts to manage a hedge position.

AEM (ARME) 344 Consumer Behavior
Fall. 3 credits. Prerequisites: AEM (ARME) 210 and AEM (ARME) 240 or equivalents. Limited to 45 juniors and seniors. Priority given to CALS students. Lecs, M W 2:55–4:10. M. G. Meloy.
This course introduces students to the psychological, sociological, and cultural theories of buyer behavior, with specific attention to consumer information processing and decision making. Class discussions, lectures, experiential exercises, and group projects are used to illustrate behavioral concepts and their application to marketing practice. The role of research in understanding and explaining consumer behavior is emphasized.

AEM (ARME) 346 Dairy Markets and Policy
Spring, weeks 1–7. 1 credit. Limited to juniors and seniors. Prerequisites: ECON 101 or equivalent. S-U grades optional. Lecs, R 2:30–4:25. M. Stephenson.
An introduction to dairy markets and policy. Major topics include: milk pricing, marketing channels, dairy trends and demographics, world trade for dairy products, and policy issues. Class participation is expected as topics and new ideas are explored.

AEM (ARME) 347 Strategic Marketing for Horticultural Firms
Spring. 1 credit. Prerequisite: AEM (ARME) 240. Lec, M 12:20–1:10. G. B. White.
This course emphasizes applications in strategic marketing. Lectures focus on practical aspects of the planning, implementation, and control phases of the strategic marketing process. Students develop a long-range marketing plan for a fruit, vegetable, greenhouse, nursery, winery, or related horticultural firm.

AEM (ARME) 380 Independent Honors Research in Social Science
Fall or spring. 1–6 credits. Limited to students who have met the requirements for the honors program. See "Honors Program" in CALS section of this catalog. Provides qualified students an opportunity to conduct original research under supervision. Information available in AEM (ARME) Undergrad Program Office in Warren Hall.

AEM (ARME) 403 Farm Management Study Trip
Spring. 1 credit. Prerequisite: AEM (ARME) 302. Open by application only. Secs, arranged. W. A. Knoblauch.
This is a special program to study production and management systems in diverse agricultural regions of the United States. Includes a trip (usually taken during spring break) to the region being studied. A different region is visited each year. The course meets in advance of the study trip and upon return from trip. A paper, selected by the student, which further explores an aspect of the trip, is a requirement for completing the course.

AEM (ARME) 404 Advanced Agricultural Finance Seminar
Spring. 2 credits. Limited to 16 seniors with extensive course work in farm management and farm finance. Open by application prior to March 1 of the year before the course is offered. W 2:30–4:25. E. L. LaDue.
A special program in agricultural finance, conducted with financial support from the Farm Credit System. Includes two days at Northeast Farm Credit offices, one week in Farm Credit Association offices, a one-day program on FSA financing during fall term, a two- to four-day trip to financial institutions in New York City, and an actual farm consulting and credit analysis experience in the spring term.

AEM (ARME) 405 Agricultural Finance
Spring. 4 credits. Prerequisite: AEM (ARME) 302 or equivalent. Lecs, M W F 9:05–9:55; sec, T 2:30–4:25. E. L. LaDue.
The principles and practices used in financing agricultural businesses, from the perspectives of the business owner and the lender. Topics include sources of capital, financing entry into agriculture, financial analysis of a business, capital management, financial statements, credit instruments, loan analysis, financial risk, and leasing.

[AEM (ARME) 410 Business Statistics
Spring. 3 credits. Prerequisite: preference given to AEM (ARME) majors. AEM (ARME) 210 or equivalent. Lecs, M W F 10:10–11:00. 2 evening prelims. Not offered spring 2002. C. van Es.
This course focuses on four major topics used to analyze data from marketing research, business, and economics. Topics studied are: survey sampling procedures, contingency table analysis, time series and forecasting, and experimental design and ANOVA. A brief introduction to nonparametric methods is also included. The course involves a research project designed to give experience in collecting and interpreting data.]

AEM (ARME) 411 Introduction to Econometrics
Spring. 3 credits. Prerequisite: AEM(ARME) 210 and either ECON 313 or PAM 200, or equivalents. Lecs, T R 2:55–4:10; sec M 7:30–9:25 P.M. D. Ng.

The course introduces students to basic econometric principles and the use of statistical procedures in empirical studies of economic models. Assumptions, properties, and problems encountered in the use of multiple regression are discussed and simultaneous equation models, simulation, and forecasting techniques are introduced.

AEM (ARME) 412 Introduction to Mathematical Programming

Fall. 3 credits. Primarily for juniors, seniors, and M.S. degree candidates. Prerequisite: AEM (ARME) 210 or equivalent. Lecs, T R 11:40–12:55; sec, T or W 1:25–2:15. J. E. Pratt.

This is a course in applied mathematical programming. Emphasis is on formulation of and interpretation of solutions to mathematical models of problems in economics and business. Blending, resource allocation, capital budgeting, transportation and financial planning, and inventory management are studied. Integer and nonlinear programming are introduced.

AEM (ARME) 415 Price Analysis (also ECON 415)

Fall. 3 credits. Prerequisites: AEM (ARME) 210 or equivalent. ECON 313 or PAM 200 or equivalent. Lecs, T R 8:40–9:55. H. M. Kaiser.

The focus of this course is on the analysis of supply and demand characteristics of commodities with particular attention to agricultural products. Special attention is paid to empirical analysis. Institutional aspects of pricing, temporal and spatial price relationships, price forecasting, and the economic consequences of pricing decisions are included.

AEM (ARME) 416 Demographic Analysis in Business and Government (also R SOC 331)

Fall. 3 credits. Prerequisite: AEM (ARME) 210 or equivalent. Lecs, M W F 1:25–2:15. W. Brown.

For description, see R SOC 331.

[AEM (ARME) 417 Decision Models for Small and Large Businesses

Spring. 3 credits. Limited to juniors and seniors. Preference given to AEM (ARME) majors. Prerequisites: AEM (ARME) 210 or equivalent. Lecs, M W F 1:25–2:15; lab W 7:30–9:25 or R 12:20–2:15 or R 2:30–4:25. In weeks labs are held, there will be no Friday lecture. Not offered spring 2002. C. L. van Es.

The course is focused on economic and statistical models of decision analysis and their application in large and small business settings. The course demonstrates how use of models can improve the decision-making process by helping the decision maker: understand the structure of the decision, incorporate subjective probabilities as a way to portray risk, measure outcomes in a way that is consistent with attitudes toward risk, and understand the value of information. The importance of sensitivity analysis is emphasized, as is the need to combine both quantitative and qualitative considerations in decision making. Cases are drawn from small business scenarios, the public policy arena, and corporate settings. Implementing decision models with computers is the focus of lab sessions.]

AEM (ARME) 420 Investments

Fall. 3 credits. Prerequisites: AEM (ARME) 210 or equivalent and AEM (ARME) 324. Recommended: ECON 313 and a calculus course. Preference given to students in AEM (ARME). Lecs, T R 1:25–2:40, sec F 9:05–9:55 or 10:10–11. S. Wang.

This course focuses on the theories and empirical data in the field of investments. Descriptions of financial institutions, markets, and instruments are also covered. Topics include: equilibrium models of security prices (CAPM, APT), fixed-income markets, derivatives, efficient market hypotheses, mutual funds, IPO, behavioral finance.

AEM (ARME) 422 Estate Planning (also NBA 562)

Fall. 1 credit. Limited to juniors, seniors, and graduate students. S-U grades only. Lecs, M 3:35–4:25. D. A. Grossman.

Fourteen sessions on the various aspects of estate-planning techniques. The law and use of trusts, the law of wills, federal and New York State estate and gift taxes, and substitutes for probate procedures are covered.

AEM (ARME) 424 Strategic Management

Fall and spring. 3 credits. Limited to AEM (ARME) seniors in Business. Fall, T R 10:10–11:25. Spring, T R 8:40–9:55 or 10:10–11:25. D. Simon.

This is a capstone course designed to integrate what students have learned in other AEM (ARME) courses with an emphasis on strategic decision making. Issues are approached from the standpoint of the board of directors, chief executive officer, and business unit managers. What should be considered and how strategic decisions should be made are the focus of the course. While the primary focus is on public corporations, not-for-profits, cooperatives, and small business strategic decisions are also included. The course is built around several high-level guest executives and a series of case studies. Improving oral and written communication skills in a business context is emphasized.

AEM (ARME) 425 Small Business Management Workshop

Fall. 4 credits. Limited to seniors. Prerequisite: AEM (ARME) 325 or NBA 300 and permission of instructor. Term project work will amount to approximately $100 per team. Lecs, M W 2:30–4:25. D. Streeter.

Students serve as counselors to small businesses in the central New York area and confront problems facing small personal enterprises. Encourages the application of business principles to an existing business and the witnessing of the results of firm-level decision making. Student teams meet with the business owners and course staff at arranged times during the semester.

AEM (ARME) 426 Cooperative Management and Strategies

Spring. 3 credits. Recommended: AEM (ARME) 220 or equivalent. Estimated cost of field trip, $60. Lecs, M W F 12:20–1:10. 2-day field trip required. B. L. Anderson.

Investigates the unique aspects of cooperative, membership, and not-for-profit organizations. Issues are approached from the point of view of management, the board of directors, and members. Topics include characteristics of various types of business organizations, cooperative principles, legislation, taxation, as well as the unique nature of strategies, management, financing, and marketing in cooperative, membership, and not-for-profit organizations. Primary focus is on operating cooperatives in agriculture, although alternative types of cooperative organizations are discussed, such as: credit unions, insurance cooperatives, employee stock ownership plans, housing cooperatives, flexible manufacturing networks, consumer cooperatives, and membership organizations.

AEM (ARME) 427 Advanced Agribusiness Management

Fall. 3 credits. Prerequisites: AEM (ARME) 220 or AEM (ARME) 302. Lecs, T R 1:25–2:40. B. A. Gloy.

The course is intended for students with an interest in agribusiness and is designed to integrate previous coursework and enhance problem identification and solving skills. The focus is on the evaluation, formulation, and implementation of strategy designed to create and sustain competitive advantage for agribusiness firms. The course covers industry analysis, firm analysis, market analysis and selection, risk analysis, strategy development, organizational design and structure, and leadership for agribusiness firms. This course is designed as a capstone course for the agribusiness management specialization.

AEM (ARME) 429 International Finance

Spring. 3 credits. Prerequisites: AEM (ARME) 210 and AEM (ARME) 324. Preference given to students in AEM. Lecs, T R 11:40–12:55, sec W 7:30–9:25 P.M. D. Ng.

The purpose of this course is to learn about issues in international financial management and international investment. The major issues that are discussed include exchange rate volatility, the benefit of international diversification, and the analysis of international capital budgeting decisions. Specific topics include the determination of the cost of capital for foreign investments, the determination and management of foreign exchange risks and country risks, and the use of innovative financing for the multinational corporation.

AEM (ARME) 430 International Trade Policy

Spring. 3 credits. Prerequisites: ECON 101–102 or equivalents and intermediate microeconomics. Recommended: AEM (ARME) 230. Lecs, T R 2:55–4:10. Optional section TBA. N. H. Chau.

This course examines the economic principles underlying international trade and monetary policy, and the policies, practices, and institutions that influence trade and foreign exchange markets. Applications to current topics in international trade policy, to trade in primary commodities, and to both developed and developing countries are also emphasized.

AEM (ARME) 431 Food and Agricultural Policies

Spring. 3 credits. Prerequisite: intermediate microeconomics. Lecs, T R 11:40–12:55; sec, R 2:30–3:20 or 3:35–4:25. H. de Gorter.

The course deals broadly with food and agricultural policies, including price support and storage or reserve policies, agricultural protection, soil conservation programs, the structure of agriculture, domestic food subsidy programs, environmental issues, and food safety. The importance of international trade and agricultural policies in other countries is emphasized.

AEM (ARME) 432 Markets or Governments?
Fall. 3 credits. Prerequisite: Intermediate microeconomics. Lec, T R 2:55–4:10. C. K. Ranney.
This course explores why certain economic activities occur in the private sector, through markets, or the public sector, through governments. Emphasis is on microeconomic analysis of public finance, public resource allocation, and the impact of those on private firm and consumer decisions. Topics include: perfectly competitive markets, market failure, public choice theory, government expenditure analysis, tax analysis, and government failure.

AEM (ARME) 433 Devolution, Privatization, and the New Public Management (also CRP 412)
Fall. 3 credits. S-U grades optional. Lec, M F 10:10–11:45. M. E. Warner.
For description, see CRP 412.

AEM (ARME) 434 Local Government Workshop (also CRP 418)
Spring. 4 credits. Prerequisite: AEM (ARME) 433. S-U grades optional. Lec, F 9:05–12:25. M. E. Warner.
For description, see CRP 418.

AEM (ARME) 443 Food-Industry Management
Fall. 4 credits. Limited to AEM (ARME) juniors and seniors in Business or Food Industry Management and grad students. Prerequisite: AEM (ARME) 240 or 448 or permission of instructor. Lecs, T R 11:40–12:55; sec T 2:55–4:10. G. A. German.
A case-study approach is used to examine the application of management principles and concepts to marketing and distribution problems of the food industry. Cases covering new product introductions, merchandising strategies, and investment decisions are included. Guest speakers from the food industry present case-study solutions at the Tuesday afternoon section.

AEM (ARME) 446 Food Marketing Colloquium
Fall. 1 credit. Limited to juniors and seniors with extensive course work in food industry management and marketing. R 3:35–4:25. D. J. Perosio.
AEM (ARME) 446 and 447 have been developed as a two-semester special seminar that provides the weekly focus for the Food Marketing Fellows Program. The seminar covers advanced topics in food marketing, many of which have an important international dimension and are presented by industry members. A number of field trips are taken. Students participate in research topics on various aspects of the food industry.

AEM (ARME) 447 Food Marketing Colloquium
Spring. 1 credit. Limited to juniors and seniors with extensive course work in food industry management and marketing. R 1:25–2:15. D. J. Perosio.
AEM (ARME) 446 and 447 have been developed as a two-semester special seminar that provides the weekly focus for the Food Marketing Fellows Program. The seminar covers advanced topics in food marketing, many of which have an important international dimension and are presented by industry members. A number of field trips are taken. Students participate in research topics on various aspects of the food industry.

AEM (ARME) 448 Food Merchandising
Spring. 3 credits. Limited to juniors and seniors. Prerequisite: AEM (ARME) 240. Lecs, T R 10:10–11:25. D. J. Perosio.
Covers merchandising principles and practices as they apply to food industry situations. The various elements of merchandising such as buying, pricing, advertising, promotion, display, store layout, profit planning and control, and merchandising strategy are examined. The consequences of food industry trends and initiatives for other industry members, public policymakers, and consumers are considered.

AEM (ARME) 449 Global Marketing Strategy
Spring. 3 credits. Prerequisite: a previous marketing course. Limited to juniors, seniors, and graduate students. M W 2:55–4:10. J. M. Hagen.
This course examines opportunities and challenges in the rapidly changing global marketplace. Topics include the decision to serve a foreign market, alternative strategies for entry into foreign markets (such as exporting or establishing a local subsidiary), and issues in implementing those strategies. The course includes case analysis and discussion.

AEM (ARME) 450 Resource Economics (also ECON 450)
Fall. 3 credits. Prerequisites: MATH 111, ECON 313, and a familiarity with EXCEL. Lecs, T R 2:55–4:10. J. M. Conrad.
Dynamic models of renewable, nonrenewable, and environmental resources are constructed to examine market allocation and optimal resource management.

AEM (ARME) 451 Environmental Economics and Policy (also ECON 409)
Spring. 3 credits. Prerequisites: ECON 313, or intermediate microeconomics course, and calculus. Limited to undergraduate students. S-U grades optional. Lecs, T R 1:25–2:40. W. D. Schulze.
This course explores the economic foundations for public decision making about environmental commodities and natural resources, using tools from intermediate microeconomics. Emphasis is placed on the welfare economic approach for allocating public goods, with specific emphasis on market failure, externalities, benefit-cost analysis, and the use of nonmarket valuation techniques. Property rights/institutional perspectives and ecological economic concepts are also examined.

AEM (ARME) 464 Economics of Agricultural Development (also ECON 464)
Spring. 3 credits. Prerequisites: ECON 101–102, or permission of instructor. Lecs, T R 11:40–12:55. R. D. Christy.
This course is designed to provide an understanding of the economics of the agricultural sector in low-income countries. In addition, more general issues of economic development beyond the agricultural sector are covered to provide the necessary context for an understanding of rural problems. Among the areas covered are the nature of development and technical change, welfare and income distribution, land reform, food and nutrition policy, food security and food aid, competition with more developed countries and international markets, the effect of U.S. policy on agricultural development, and the role of international institutions. Examples from a wide variety of developing countries are used to illustrate the basis for economic analysis.

AEM (ARME) 494 Undergraduate Special Topics in Applied Economics and Management
Fall or spring. 4 credits maximum. S-U grades optional. Staff.
The department teaches "trial" courses under this number. Offerings vary by semester and are advertised by the department before the beginning of the semester.

AEM (ARME) 497 Individual Study in Applied Economics and Management
Fall or spring. Variable credit. S-U grades optional. Students must register with an Independent Study form (available in the Undergraduate Program Office in Warren Hall). Staff.
Used for special projects designed by faculty members.

AEM (ARME) 498 Supervised Teaching Experience
Fall or spring. 1–4 credits. Total of 4 credits maximum during undergraduate program. Students must register with an Independent Study form (available in the Undergraduate Program Office in Warren Hall). Staff.
Designed to give qualified undergraduates experience through actual involvement in planning and teaching courses under the supervision of department faculty. Students are expected to teach at least one hour per week for each credit awarded. Students cannot receive both pay and credit for the same hours of preparation and teaching.

AEM (ARME) 499 Undergraduate Research
Fall, spring, or summer. 1–4 credits. Limited to students with GPAs of at least 2.7. Students must register with an Independent Study form (available in the Undergraduate Program Office in Warren Hall). S-U grades optional. Staff.
Permits outstanding undergraduates to carry out independent study of suitable problems under appropriate supervision. Students cannot receive both pay and credit for the same hours of work.

AEM (ARME) 555 Environmental Management and Policy
Fall. 3 credits. Prerequisite: ECON 101 and 102 or equivalents and calculus. Lecs, M W F 11:15–12:05. L. D. Chapman.
This seminar intends to familiarize students with the rapidly evolving state of the art in the analysis and management of environmental policy and practice in enterprise. Although focused on the private sector, some attention is given to public enterprises.

AEM (ARME) 605 Agricultural Finance
Fall. 3 credits. Prerequisite: AEM (ARME) 324 or 405 or equivalent. T R 8:40–9:55. B. A. Gloy.
Advanced topics in agricultural finance. Topics include investment analysis, capital budgeting under uncertainty, decision analysis, risk management, capital structure, and financial intermediaries.

AEM (ARME) 608 Production Economics (also ECON 408)
Fall. 3 credits. Recommended: ECON 313 and MATH 111 or equivalents. Lecs, M W F 10:10–11. L. W. Tauer.

The theory of production economics with emphasis on applications to agriculture and natural resources. Topics include the derivation, estimation, and use of production, cost, profit, demand, and supply functions. Production response over time and under risk is introduced.

AEM (ARME) 630 Policy Analysis: Welfare Theory, Agriculture, and Trade (also ECON 430)
Spring. 4 credits. Prerequisites: AEM (ARME) 608 or PAM 603, ECON 313, or equivalent intermediate micro theory incorporating calculus. Lecs, M W 12:20–2:15. H. de Gorter.
The first half of the course surveys the theory of welfare economics as a foundation for public policy analysis. Major issues addressed include the problem of social welfare measurement, the choice of welfare criteria, and the choice of market or nonmarket allocation. Basic concepts covered include measurement of welfare change, including the compensation principle, consumer and producer surplus, willingness-to-pay measures, externalities, and the general theory of second-best optima. The second half of the course focuses on public policy analysis as applied to domestic agricultural policy and international trade. The domestic policy component examines major U.S. farm commodity programs and related food and macroeconomic policies and analyzes their effects on producers, consumers, and other groups. The international trade component examines the structure of world agricultural trade, analytical concepts of trade policy analysis, and the principal trade policies employed by countries in international markets.

AEM (ARME) 632 Open Economy Analysis: Theory and Applications
Spring. 3 credits. Prerequisites: ECON 313, ECON 314, and permission of instructor. S-U grades optional. Lecs, T R 11:40–12:55. N. Chau and S. Kyle.
This course explores both recent theoretical and methodological advances as well as practical applications in analyzing current topics and issues in open economies. It brings together research methods pertinent to open economy macroeconomics and international trade policies, to give students a basic understanding of how different aspects of contemporary debates are analyzed in practice.

AEM (ARME) 633 Devolution, Privatization, and the New Public Management (also CRP 612)
Fall. 3 credits. S-U grades optional. Lec, M F 10:10–11:45. M. E. Warner.
For description, see CRP 612.

AEM (ARME) 634 Local Government Workshop (also CRP 618)
Spring. 4 credits. Prerequisite: AEM (ARME) 633. S-U grades optional. Lec, F 9:05–12:25. M. E. Warner.
For description, see CRP 618.

AEM (ARME) 640 Analysis of Agricultural Markets (also ECON 440)
Fall. 3 credits. Prerequisites: AEM (ARME) 411 and 415 or equivalents. Lecs, T R 2:55–4:10. H. M. Kaiser.
This course focuses on the unique features of agricultural commodity markets. Focus is placed on government and private institutions impacting these markets, as well as on models of price behavior including marketing margins and imperfect competition. Empirical tools to evaluate market characteristics are also covered.

AEM (ARME) 641 Commodity Futures Markets (also ECON 441)
Spring, weeks 8–14 (starts Mar. 11). 2 credits. Prerequisites: AEM (ARME) 411 and 415 or equivalents. Recommended: AEM (ARME) 640. Lecs, T R 12:20–2:15. W. G. Tomek.
This course is about markets for agricultural futures contracts. Emphasis is placed on models of price behavior on futures markets including relationships among cash and futures prices. These principles provide a foundation for a discussion of hedging, speculation, and public-policy issues.

AEM (ARME) 651 Environmental and Resource Economics
Spring. 4 credits. Limited to graduate students. Lecs, T R 10:10–11:25. W. D. Schulze.
A review of welfare economics, environmental externalities, and common property resources, and a survey of current environmental and natural resource policy. Techniques for measuring benefits and cost—including property value and wage, hedonic approaches, travel cost models, and contingent valuation—are covered. Survey/data collection methods are described in detail. Innovative market mechanisms for resolving public good, common property, and externality problems are explored. Students are required to complete a paper describing their own formal economic analysis of a natural resource or environmental problem. Open to graduate students outside of economics. AEM (ARME) 651 is a core course for the Environmental Management concentration/option.

AEM (ARME) 652 Land Economics Problems (co-listed with CEE 529)
Fall or spring. 1 or more credits. Limited to graduate students. Prerequisite: permission of instructor. S-U grades optional. W 7:30–9:25 P.M. D. J. Allee.
Special work on any subject in the field of land and resource economics.

AEM (ARME) 655 Electric Systems Engineering and Economics (also ECE 551)
Fall. 2 credits. Prerequisites: basic calculus and microeconomics. Lecs, to be arranged. T. D. Mount and R. Thomas.
For description, see ECE 551.

AEM (ARME) 660 Agroecosystems, Economic Development and the Environment
Spring. 3 credits. Prerequisites: introductory microeconomics and intermediate statistics (i.e. including multiple regression) or permission of instructor. Limited to graduate students. An additional section will be arranged for economics majors. S-U grades optional. Lecs, M W 2:55–4:10. D. R. Lee.
This course examines selected topics in agricultural and economic development, technology assessment, ecosystem management and the environment, with a focus on developing countries. Topics covered include production, poverty, and environmental tradeoffs; sustainable technology development; trade and environment linkages; economics of conservation and development; and alternative methodologies for analyzing these interactions. Readings emphasize the economic literature, but also draw from the biophysical sciences, ecosystem management, and the social sciences. This course is open to graduate students outside of economics.

AEM (ARME) 665 Food and Nutrition Policy (also NS 685)
Spring. 3 credits. Prerequisites: introductory microeconomics and intermediate statistics (i.e. through multiple regression), or permission of instructor. S-U grades optional. Lecs, M W 2:55–4:10. D. Sahn.
For description, see NS 685.

[AEM (ARME) 666 Economics of Development (also ECON 466)
Spring. 3 credits. Prerequisites: ECON 313 and 314 or permission of instructor. S-U grades optional. Lecs, T R 11:40–12:55. Not offered spring 2002. S. C. Kyle.
The course is designed as an introduction to the economics of development at the graduate level. The course is split into two major sections, the first dealing with the microeconomics of households in developing countries and the second covering macroeconomic strategy and performance. A principal goal is to illuminate the particular features of low-income countries which are important to economic analysis and policy. Special attention is given to issues facing countries with important agricultural and resource sectors.]

AEM (ARME) 667 Topics in Economic Development (also ECON 770)
Fall. 3 credits. Prerequisite: basic first-year courses in ECON or AEM (ARME), or instructor's permission. S-U grades optional. Lecs, W 1:25–4:25. R. Kanbur.
This course is targeted to second-year graduate students. Topics covered vary from year to year but may include: poverty, inequality, intra-household allocation, structural adjustment, and debt. Examination is by term paper.

AEM (ARME) 670 Economics of Consumer Demand (also PAM 608)
Fall. 3 credits. Prerequisites: ECON 311 or 313 and 2 semesters of calculus. S-U grades optional. Lecs, T R 10:10–11:25. C. K. Ranney.
A graduate level introduction to theory and empirical research on household demand, consumption, and saving. Emphasis is on the use of the theory in empirical research. Topics include neo-classical theory of demand, duality, complete demand systems, conditional demand, demographic scaling and translating, consumption, and savings. As time allows, Becker and Lancaster models of demand may be introduced.

AEM (ARME) 694 Graduate Special Topics in Applied Economics and Management
Fall or spring. 4 credits maximum. S-U grades optional. Staff.
The department teaches "trial" courses under this number. Offerings vary by semester, and are advertised by the department before the beginning of the semester.

AEM (ARME) 698 Supervised Graduate Teaching Experience
Fall or spring. 1–4 credits. Total of 4 credits maximum during graduate program. Students must register with an Independent Study form (available in the Undergraduate Program Office in Warren Hall). Open only to graduate students.

Undergraduates should enroll in AEM 498. S-U grades optional. Prerequisite: permission of instructor. Staff.

Designed to give graduate students teaching experience through involvement in planning and teaching courses under the supervision of departmental faculty members. The experience may include leading discussion sections, preparing, assisting in, or teaching lectures and laboratories, and tutoring. Students are expected to actually teach at least one hour per week for each credit awarded. Students cannot receive both pay and credit for the same hours of preparation and teaching.

AEM (ARME) 699 M.P.S. Research

1–6 credits. Prerequisite: registration as an M.P.S. student. Credit is granted for the M.P.S. project report. Staff.

AEM (ARME) 700 Individual Study in Applied Economics and Management

Fall or spring. Limited to graduate students. S-U grades optional. Credit, class hours, and other details arranged with a faculty member. Staff.

This course is used for special projects designed by faculty members. More than one topic may be given each semester in different sections. The student must register in the section appropriate to the topic being covered; the section number is provided by the instructor.

[AEM (ARME) 708 Advanced Production Economics

Fall. 3 credits. Prerequisite: AEM (ARME) 608, 710, or equivalents; ECON 609 is highly recommended. Offered alternate years. Offered fall 2002 and 2004. Not offered fall 2001. Hours TBA. R. N. Boisvert.

Covers theoretical and mathematical developments in production economics, with emphasis on estimating production relationships, scale economies, technical change, and factor substitution. Developments in flexible functional forms, duality, and dynamic adjustment models are emphasized. Discussions of other topics (risk, supply response, and household production functions) based on student interest.]

AEM (ARME) 710 Econometrics I

Spring. 3 credits. Prerequisites: statistical methods at the level of ILRST 311 or ECON 619. Undergraduates must have permission of instructor. Lecs, M W F 9:05–9:55. T. D. Mount.

This course, together with AEM (ARME) 711, provides a graduate sequence in applied econometrics that is suitable for M.S. and Ph.D. students. AEM (ARME) 710 covers linear regression models and the associated estimation and testing procedures. Models from demand and production theory are used as illustrations.

AEM (ARME) 711 Econometrics II

Fall. 3 credits. Prerequisite: AEM (ARME) 710 or equivalent. Lecs, M W F 10:10–11:00. T. D. Mount.

Coverage beyond AEM (ARME) 710 of dynamic models, including single equation ARIMA, vector ARIMA, Kalman filtering, structural dynamic models, and regime switching. Topics covered include endogeneity, stability, causality, and cointegration.

[AEM (ARME) 712 Quantitative Methods I

Fall. 4 credits. Prerequisite: some formal training in matrix algebra. A course at the level of BTRY 417 is highly recommended. Lecs, M W F 8:40–9:55. Not offered fall 2001. R. N. Boisvert.

A comprehensive treatment of linear programming and its extensions, including postoptimality analysis. Topics in nonlinear programming, including separable, spatial equilibrium and risk programming models. Input-output models and their role in social accounting matrices and computable general equilibrium models are discussed. Applications are made to agricultural, resource, and regional economic problems.]

AEM (ARME) 713 Quantitative Methods II

Spring. 3 credits. Prerequisite: ECON 609. S-U only. Lecs, T R 8:40–9:55. J. M. Conrad.

This course is concerned with the analysis and optimization of dynamic systems. Course objectives are to (1) present the basic theory of dynamical systems and dynamic optimization, (2) introduce associated methods of optimization and numerical analysis, (3) review some applications of dynamic analysis from various subfields in economics, and thereby (4) equip students with basic theory and methods to perform applied research on dynamic allocation problems.

AEM (ARME) 714 Experimental Economics

Fall. 4 credits. Prerequisite: ECON 609. Offered alternate years. Offered fall 2001 and 2003. Not offered fall 2002. Lecs TBA. W. D. Schulze.

The course will survey both experimental economics methods and research as an approach to test economic theory. Students will participate as subjects in a series of illustrative computerized experiments ranging from double auctions to public goods provision. Topics covered include experimental methods; decisions and games; markets (testing auction institutions); market power (monopoly, oligopoly); bargaining, compensation and performance; public goods; externalities and voting; information and uncertainty; and economic anomalies. Students must design and write a paper describing their own experiment.

AEM (ARME) 717 Research Methods in Agricultural Economics

Spring. 2 credits. Limited to graduate students. T 2:30–4:25. R. N. Boisvert.

Discussion of the research process and scientific method as applied in agricultural economics. Topics include problem identification, hypotheses, sources of data, sampling concepts and designs, methods of collecting data, questionnaire design and testing, field organization, and analysis of data. During the semester each student develops a research proposal that may be associated with his or her thesis.

[AEM (ARME) 730 Seminar on International Trade Policy: Agriculture, Resources and Development

Spring. 3 credits. Limited to graduate students. Prerequisites: AEM (ARME) 630 or equivalent. Offered alternate years. Not offered spring 2002 and 2004. Next offered spring 2003. Hours TBA. D. R. Lee.

This course examines selected topics in the professional literature on international trade policy, focusing on agricultural trade and related topics, including trade liberalization, trade and environmental linkages, technological change and trade policy, and agricultural trade and development.]

AEM (ARME) 735 Public Finance: Resource Allocation and Fiscal Policy (also ECON 735)

Fall. 4 credits. Time TBA. R. Kanbur.

For description, see ECON 735.

AEM (ARME) 740 Agricultural Markets and Public Policy

Spring, weeks 1–7. 2 credits. Limited to graduate students. Prerequisite: familiarity with multiple regression techniques at the AEM (ARME) 411 level or higher. Recommended: AEM (ARME) 640. T R 12:20–2:15. W. H. Lesser.

Develops the concepts and methodology for applying and analyzing the effects of public-policy directives to the improvement of performance in the U.S. food marketing system. Prospective topics include a survey of industrial organization principles, antitrust and other legal controls, and coordination systems in agriculture. Topics may be adjusted to students' interests.

AEM (ARME) 750 Resource Economics

Fall. 3 credits. Prerequisites: ECON 609 and 618, or AEM (ARME) 713. Lecs, T R 8:40–9:55. J. M. Conrad.

Optimal control and other methods of dynamic optimization are used to study the allocation and management of natural resources.

[AEM (ARME) 751 Environmental Economics

Spring. 4 credits. Prerequisites: ECON 609 and 618, or AEM (ARME) 713. S-U grades optional. Hours TBA. Offered alternate years. Not offered spring 2002 and 2004. Next offered spring 2003. R. N. Boisvert.

This course is the study of the basic theory and applications of environmental economics and policy. Extensions include comparisons of taxes, subsidies and other policy instruments, an examination of the effects on policy of market imperfections, multiple positive and negative externalities, and other government regulations such as those in agriculture. Also examined are the effects of uncertainty, and special problems associated with non-point externalities and asymmetric information. There is an extensive treatment and evaluation of contingent valuation and other methods for valuing non-market goods. Throughout, the theoretical results are highlighted through discussions of important empirical policy applications.]

AEM (ARME) 762 Microeconomics of International Development

Fall. 3 credits. Prerequisite: completion of first year Ph.D. course sequence in AEM (ARME) or ECON, or instructor's permission. S-U grades optional. Lecs, T R 2:30–4:00. C. B. Barrett.

This course focuses on models of individual, household, firm/farm, and market behavior in low- and middle-income developing economies. Topics covered include: agricultural land, labor and financial institutions, technology adoption, food security and nutrition, risk management, intra-household analysis, reciprocity networks, and product/factor markets analysis. Empirical investigation is emphasized.

[AEM (ARME) 763 Macro Policy in Developing Countries
Spring. 3 credits. Prerequisites: ECON 609, 610, 613 (may be taken concurrently), or permission of instructor. Offered alternate years. Not offered spring 2002 and 2004; next offered spring 2003. Lec, T 2–4:25. S. C. Kyle.
This course examines macroeconomic policies in developing countries and their interaction with economic growth, development, and stability. Theoretical models useful for analysis of macro policies are covered as well as an examination of empirical studies. Emphasis is on research topics of current interest to students and professionals in the field, particularly those relating to the interaction of macro policy with micro and sectoral analysis.]

AEM (ARME) 800 Master's-Level Thesis Research
Fall or spring. 1–9 credits. Prerequisite: permission of graduate committee chair. S-U grades only. Graduate faculty.
For students admitted specifically to a master's program.

AEM (ARME) 900 Graduate-Level Thesis Research
Fall or spring. 1–9 credits. Prerequisite: permission of graduate committee chair. S-U grades only. Graduate faculty.
For students in a Ph.D. program **only before** the "A" exam has been passed.

AEM (ARME) 901 Doctoral-Level Thesis Research
Fall or spring. 1–9 credits. Prerequisite: permission of graduate committee chair. S-U grades only. Graduate faculty.
For students admitted to candidacy **after** the "A" exam has been passed.

ANIMAL SCIENCE

A. W. Bell, chair; R. E. Austic, D. E. Bauman, R. W. Blake, Y. R. Boisclair, D. L. Brown, W. R. Butler, L. E. Chase, G. F. Combs, W. B. Currie, H. N. Erb, R. W. Everett, D. G. Fox, D. M. Galton, R. C. Gorewit, H. F. Hintz, P. A. Johnson, K. Keshavarz, X. G. Lei, E. A. Oltenacu, P. A. Oltenacu, T. R. Overton, J. E. Parks, A. N. Pell, E. J. Pollak, R. L. Quaas, S. M. Quirk, R. D. Smith, M. L. Thonney, M. E. Van Amburgh

AN SC 100 Domestic Animal Biology I
Fall. 4 credits. S-U grades optional. Lecs, M W F 9:05; sec, T W or R 2–4:25. W. B. Currie.
An introduction to the biology of economically important species (morphology, anatomy, and physiology) and its application to the management of animals in major livestock industries. Topics covered include: fundamentals of genetic selection and relevant biometry, anatomy, quantitative cell biology, regulatory mechanisms, public domain genetic databases, major life support systems, and digestion. Students undertake the care and management of several species of farm animals and conduct a genetic selection experiment with a large colony of Japanese quail. Laboratory exercises include examining aspects of growth and development. Living farm animals are used noninvasively, and fresh organs from dead animals are examined.

AN SC 105 Contemporary Perspectives of Animal Science
Spring. 1 credit. Limited to freshmen, sophomores, and first-year transfers. T 1:25 or W 12:20. R. C. Gorewit and D. J. Cherney.
A forum to discuss the students' career planning and the contemporary and future role of animals in relation to human needs.

AN SC 110 The Animals That Sustain Us
Spring. 3 credits. S-U grades optional. Lecs, T R 9:05; lab, T 1:25–4:25. D. L. Brown.
Students completing this course understand the importance of the symbiosis between humans and domestic animals, learn how animal enterprises can be ethically, environmentally and economically sound, and are able to care for various species of domestic animals. Lab sessions feature both live farm animals and computer simulations.

AN SC 120 Animal Domestication and Behavior
Fall. 3 credits. T R 8:40–9:55. E. A. Oltenacu.
This Freshman Writing Seminar explores the relationship between humans and their domestic animals. Students study the role of animal behavior in the domestication process, both historically and in modern attempts to domesticate new species, and in finding solutions to current issues related to animal welfare.

AN SC 150 Domestic Animal Biology II
Spring. 4 credits. S-U grades optional. Lec, M W F 9:05; lab/disc T W or R 2–4:25. W. R. Butler and staff.
Second of a two-semester sequence (100/150) applying the basic biology of growth, defense mechanisms, reproduction, and lactation to aspects of the production and care of domestic animals. Fresh tissues and organs from dead animals along with preserved specimens are used in laboratories, exercises, and demonstrations. A quail colony will be used for growth exercises and data collection.

AN SC 212 Animal Nutrition
Fall. 4 credits. Prerequisite: CHEM 208 or equivalent. Recommended: AN SC 100 and 150. Lecs, M W F 10:10; lab, M T W R or F 1:25–4:25. A. W. Bell and D. J. R. Cherney.
An introduction to animal nutrition, including digestive physiology and metabolism of domestic animals and other species; nutrient properties and requirements for different aspects of animal production and performance; principles of feed evaluation and ration formulation. Laboratory classes include gastrointestinal tract dissections and a nutritional experiment performed on a laboratory or farm animal species.

[AN SC 213 Nutrition of the Dog
Spring, weeks 1–7. 1 credit. Prerequisite: AN SC 212 or equivalent. Offered alternate years. Next offered spring 2003; not offered spring 2002 or 2004. Lecs W 7:30–9:25 P.M. H. F. Hintz.
Nutrition of the dog. Digestive physiology, nutrient requirements, feeding practices, and interactions of nutrition and disease.]

AN SC 214 Nutrition of Exotic Animals
Spring, weeks 1–7. 1 credit. Prerequisite: AN SC 212. Offered alternate years. Next offered spring 2002, 2004; not offered spring 2003. Lec, W 7:30–9:25 P.M. H. F. Hintz.
Principles of nutrition for exotic animals. Nutrient requirements, sources of nutrients, feeding management systems, and ration formulation are discussed. Signs of nutrient deficiencies and excesses are described.

AN SC 215 Exotic Avian Husbandry and Propagation
Fall. 2 credits. Limited to 100 students. Prerequisites: AN SC 100, 150 or one year of introductory biology. Lec, M 2:30–4:30. J. Parks and D. Muscarella.
Natural history, care, management, health, and breeding of exotic avian species with emphasis on psittacines (parrots and related species) and raptors (birds of prey). Includes lectures, demonstrations, and local field trips.

[AN SC 216 Nutrition of the Cat
Fall, weeks 1–7. 1 credit. Prerequisite: AN SC 212 or equivalent. Offered alternate years. Next offered fall 2002; not offered fall 2001 or 2003. Lecs, W 7:30–9:25 P.M. H. F. Hintz.
Nutrition of the cat. Digestive physiology, nutrient requirements, feeding practices, and interactions of nutrition and disease.]

AN SC 221 Introductory Animal Genetics
Spring. 3 credits. Prerequisite: a year of college biology. Lecs, T R 9:05; sec, T W R or F 2–4:25. E. J. Pollak.
An examination of basic genetic principles and their application to the improvement of domestic animals, with emphasis on the effects of selection on animal populations.

AN SC 222 Introduction to Canine Genetics
Fall, spring or summer. 1 credit. Prerequisites: introductory biology or permission of instructor. To receive credit, register through the School of Continuing Education, http://www.sce.cornell.edu/DL/html/caninegenetics.html. E. J. Pollak and P. A. Oltenacu.
Introduction to basic Mendelian genetics and simply inherited characteristics in the dog. This distance-education course delivered by CD and web interaction for residents and nonresidents consists of lectures on basic genetic principles, probabilities, linkage and genetic testing, and seminars on genome mapping, inherited sexual disorders, bleeding disorders, and eye defects. This course cannot be taken for credit by students who have successfully completed AN SC 221.

AN SC 250 Dairy Cattle Principles
Fall. 3 credits. S-U grade optional. Lecs, T R 10:10; lab, T 1:25–4:25. D. M. Galton and T. Batchelder.
Introduction to the background and scientific principles relating to dairy cattle production. Laboratories are designed to provide an understanding of production techniques. This course is a prerequisite for AN SC 251, 351, and 355.

AN SC 251 Dairy Cattle Selection
Fall. 2 credits. Prerequisite: AN SC 250 or equivalent. S-U grades optional. Lec, W 1:25–2:15; disc, W 2:15–4:25. D. M. Galton.
Covers the application of scientific principles of genetic programs in herds with different breeding programs. Emphasis is on economical traits to be used to improve genetic progress and herd profitability.

AN SC 265 Horses
Fall. 3 credits. Prerequisites: AN SC 100 and 150 or permission of instructor. S-U grades optional. Lecs, T R 9:05; lab, R 1:25–4:25. C. Collyer.

Selection, management, feeding, breeding, and training of light horses.

AN SC 280 Molecular Biology in Agriculture and Medicine
Fall. 2 credits. Prerequisite: one year of introductory biology. Lec, T R 10:10. S. M. Quirk.
The applications of molecular biology to animal research, animal agriculture, industry, and medicine are discussed. An introduction of basic recombinant DNA techniques is followed by topics such as genome projects, functional genomics, transgenic animal production, mammalian cloning, gene therapy, and genetic screening. Ethical issues raised by use of these techniques are discussed.

AN SC 290 Meat Science (also FOOD 290)
Fall. 2 or 3 credits. Lecs, T R 11:15; lab, M or R 12:20–3:20. Lecture only, 2 credits; lecture plus lab, 3 credits; lab cannot be taken without lecture. D. Shaw.
An introduction to meat science through a study of the structure, composition, and function of muscle and its conversion to meat. Properties of fresh and processed meat, microbiology, preservation, nutritive value, inspection, and sanitation are also studied. Laboratory exercises include anatomy, meat-animal slaughter, meat cutting, wholesale and retail cut identification, inspection, grading, curing, sausage manufacture, and quality control. An all-day field trip to commercial meat plant may be taken.

AN SC 300 Animal Reproduction and Development
Spring. 3 credits. Prerequisite: AN SC 100–150 or equivalent and 1 year of introductory biology. Lecs, M W F 10:10. J. E. Parks.
Comparative anatomy and physiology of mammalian and avian reproduction, with emphasis on domestic and laboratory animals. Fertilization through embryonic development, pregnancy, and growth to sexual maturity; emphasis on physiological mechanisms and application to fertility regulation. Separate laboratory offered to demonstrate fundamental aspects of reproduction and reproductive technology.

AN SC 301 Animal Reproduction and Development Lab
Spring. 1 credit. Prerequisite: AN SC 100–150 or equivalent. Concurrent enrollment in or completion of AN SC 300 required to register. Labs, M W or F 1:25–4:25. Each lab limited to 30 students. J. E. Parks.
Demonstration of fundamental principles and applied aspects of mammalian and avian reproduction. A limited number of live animals are used in some demonstrations. Dissection and examination of tissues from vertebrate animals are included in selected laboratories.

AN SC 305 Farm Animal Behavior (also BIOAP 312)
Spring. 2 credits. Prerequisites: introductory animal physiology (AN SC 100 and 150 or equivalent); at least 1 animal production course or equivalent experience is recommended. S-U grades optional. Lec, T R 11:15. E. A. Oltenacu and K. A. Houpt.
The behavior of production species (avian and mammalian) influences the success of any management program. Students study behaviors relating to communication, learning, social interactions, reproduction, and feeding of domestic animals and their physiological basis. Management systems for commercial livestock production and their implications for animal behavior and welfare are stressed.

AN SC 321 Applied Animal Genetics Seminar
Fall. 2 credits. Prerequisite: AN SC 221 or equivalent. S-U grades only. Lec, M 12:20; disc, M 1:25. P. A. Oltenacu and E. J. Pollak.
Topics of interest related to the genetic definition and control of qualitative and quantitative traits in various species of animals are presented. Genetic conservation programs and current animal improvement strategies as well as challenges presented by new developments in reproductive biology and molecular genetics are addressed in a lecture discussion-type format.

AN SC 323 Equine Genetics Seminar
Fall. 1 credit. Prerequisite: AN SC 221 or equivalent. S-U grades only. Disc, T 1:25-2:15. P. A. Oltenacu and staff.
Topics of equine genetics are presented and discussed. Independent library research, a short written paper, and an oral presentation are important parts of this course. Lecture topics may include the genetic aspects of color, abnormalities, metabolic diseases, unsoundness, and performance.

AN SC 330 Poultry Biology, Nutrition, and Management
Spring. 2 credits. Prerequisites: AN SC 100 and 150 or permission of instructor. Offered alternate years. Next offered spring 2002, 2004; not offered spring 2003. Lec, F 2–4 (occasional field trips run past 4 P.M.). K. Keshavarz.
The course focuses on anatomy and physiology of various organs of poultry. Principles of poultry nutrition, breeding, and embryology are discussed with an emphasis on their practical application. The student becomes familiar with the concept of least-cost feed formulation for poultry. The course also is designed to provide an understanding of current technology involved in commercial poultry production.

[AN SC 341 Biology of Lactation
Spring. 2 credits. Prerequisite: AN SC 100–150 or Animal Physiology. Offered alternate years. Next offered spring 2003; not offered spring 2002, 2004. Lecs, T R 9:05. Y. R. Boisclair and staff.
A comprehensive survey of the biology of the mammary gland. Lectures cover: (1) basic aspects such as anatomy and development of the mammary gland, biochemistry and hormone regulation of milk synthesis and regulation of gene expression in the mammary cells; (2) practical aspects such as the impact of lactation on nutrition, reproduction, and diseases. Lactation in the dairy cow provides the primary context to the course, but examples from other mammals including humans are used.]

AN SC 351 Dairy Herd Management
Spring. 4 credits. Prerequisites: AN SC 250 or permission of instructor. Recommended: AEM (ARME) 302. Lecs, M W F 11:15; labs, W 1:25–4:25, and F (alternate weeks) 1:25–4:25. D. M. Galton and T. L. Batchelder.
Application of scientific principles to practical herd management with components of reproduction, milking, housing, records, and production economics. Laboratories emphasize practical applications, analyses of alternatives, decision making, field trips, and discussion.

AN SC 355 Dairy Nutrition and Health
Spring. 3 credits. Prerequisite: AN SC 250 and permission of instructor. Letter only. Lecs, T R 10:10; lab, M 1:25–4:25. D. M. Galton, L. E. Chase and T. L. Batchelder.
Application of scientific principles to practical herd management with components of nutrition and herd health. Laboratories emphasize practical applications, analyses of alternatives, decision making, field trips, and discussion.

AN SC 360 Beef Cattle
Spring. 3 credits. Lec, T R 10:10; sec, W 2:00–4:25. Offered alternate years. Next offered spring 2002, 2004; not offered spring 2003. M. L. Thonney.
Emphasis is on the management of reproduction, nutrition, and selection in beef cattle enterprises. A cattle growth model is studied. Laboratories acquaint students with management skills through computerized simulations and working directly with cattle. Students spend several days during the semester feeding and caring for cows and their newborn calves.

AN SC 365 Equine Nutrition
Fall. 3 credits. Prerequisites: AN SC 100, 212, and 265 or equivalent. S-U grades optional. Lec, M W F 9:05–9:55. H. F. Hintz.
The principles of nutrition for horses are presented. Digestive physiology, sources of nutrients, feeding programs for various classes of horses and interactions of nutrition and diseases are discussed.

[AN SC 370 Swine Nutrition and Management
Fall. 3 credits. Recommended: AN SC 212. Lec, T R 11:15; lab, T 2–4:25. Offered alternate years. Next offered fall 2002; not offered fall 2001, 2003. X. G. Lei and K. Roneker.
This course focuses on swine nutrition, feeding, and management. Lectures are integrated basic nutrition and swine system including pig biology, digestive and metabolic development, nutritional biochemistry and physiology, impact of swine nutrition on environment, use of pig model in medicine, and current swine nutrition and biotechnology. Laboratory practice, animal projects, and problem troubleshooting are offered.]

[AN SC 380 Sheep
Spring. 3 credits. Lec, T R 10:10; sec, W 2:00–4:25. Offered alternate years. Next offered spring 2003; not offered spring 2002, 2004. M. L. Thonney.
Emphasis is on the breeding, feeding, management, and selection of sheep from a production-system approach. Lectures and laboratories are designed to give students a practical knowledge of sheep production as well as the scientific background for improved management practices. Students work directly with sheep during laboratories and spend several days during the semester feeding and caring for ewes and their newborn lambs.]

AN SC 400 Livestock in Tropical Farming Systems
Spring. 3 credits. Prerequisite: upperclass standing. Lecs, T R 9:05; disc W 1:25–3:20. R. W. Blake.

An analysis of constraints on livestock production in developing countries of the tropics, economic objectives and risk, and production methods. Emphasis is on strategic use of animal and plant resources, animal performance with inputs restricted, decision making, and alternative systems of production. Principles, real examples, independent study projects, and classroom interactions aid problem-solving efforts to improve food security.

AN SC 401 Dairy Production Seminar
Spring. 1 credit. Limited to juniors and seniors. Disc, M 7:30 P.M. D. E. Bauman and T. R. Overton.
Capstone course where students, with the help of faculty members, complete a study of the research literature on topics of current interest in the dairy industry. Students then make an oral and a written report on their topic with emphasis on integrating theory and practice.

AN SC 402 Seminar in Animal Sciences
Spring. 1 credit. Limited to juniors and seniors. May be repeated. S-U grades optional. Lec, M 4:30. W. B. Currie.
Review of literature pertinent to topics of animal science or reports of undergraduate research and Honors projects. Students present oral reports of their work for class discussion in addition to written reports.

[AN SC 403 Tropical Forages
Spring. 2 credits. Limited to seniors and graduate students except by permission of instructor. Prerequisites: crop production and livestock nutrition. Offered alternate years. Next offered spring 2003; not offered spring 2002, 2004. Lecs, T R 10:10. A. N. Pell.
An overview of tropical grasslands, seeded pastures, and crop residues as feed resources; grass and legume characteristics; establishment and management of pastures; determination of feeding value of forages and crop residues; physiology of digestion of ruminants that affects feeding behavior; problems of chemical inhibitors in plants; and preservation of tropical forages as hay or silage.]

AN SC 410 Nutritional Physiology and Metabolism
Fall. 3 credits. Prerequisites: biochemistry and physiology. M W F 11:15. R. E. Austic and D. E. Bauman.
A fundamental approach to nutrition focusing on the metabolic fate of nutrients and the interrelationships among nutrients, nutritional state, and metabolic processes. The overall goal is to increase understanding of metabolism and metabolic regulation through an integration of nutrition, biochemistry, and physiology.

AN SC 411 Applied Cattle Nutrition
Fall. 4 credits. Prerequisites: AN SC 100 and 212 (or equivalent); AN SC 355 is strongly encouraged. Lecs, M W F 10:10; lab, M 1:25–4:25. M. E. Van Amburgh.
An applied approach to predicting nutrient requirements and feed utilization to meet requirements with wide variations in cattle type, feed composition, and environmental conditions. Dairy cattle are emphasized. Nutrient management to minimize cost of production and environmental effects is discussed. Computer models (Cornell Net Carbohydrate and Protein System) are used in the laboratory to apply the information presented in lectures, including evaluation of feeding programs on case study farms. Course is designed for juniors, seniors, and entering graduate students.

AN SC 412 Livestock and the Environment
Spring. 2 or 4 credits. No prerequisite for 2 credits (weeks 1–8). Students who have taken AN SC 411 can sign up for 4 credits (full semester) to take the lab section, which involves whole-farm environmental planning. Lec, T R 11:15–12:05; lab T 1:30–4:30. D. G. Fox.
This course explores controversial issues surrounding livestock and the environment, including competition with humans for food resources, impact of animal products on human health, and impact of livestock farms on environmental/community problems, including odor, pathogens, and excess nutrient effects on water quality. Those taking the lab section for two additional credits use computer software tools to evaluate aspects of whole-farm nutrient and environmental management on case study farms, with data collection and analysis continuing throughout the semester.

AN SC 414 Ethics and Animal Science
Fall. 2 credits. Enrollment limited to 20 students, juniors and seniors only. Lec, M 12:20; disc, W 12:20–1:10. One Saturday morning, required farm tour. D. J. R. Cherney.
Exploration of the place of humans in the biological world, origins of ethics and morality, speciesism, the use of animals for research and agricultural purposes, transgenic animals. A report on the farm tour or a book review, participation in discussion and a project of the student's choice are used to evaluate the performance of each student.

AN SC 420 Quantitative Animal Genetics
Spring. 2 credits. Prerequisite: AN SC 221 or equivalent. Limited to 30 students. Lec, M 12:20; sec, M 2–4:25. E. J. Pollak.
A consideration of problems involved in improvement of animals through application of the theory of quantitative genetics, with emphasis on genetic evaluation and analysis of data for genetic parameters. Computer labs use interactive matrix algebra programs for problem solving.

AN SC 425 Gamete Physiology and Fertilization
Fall. 2 credits. Limited to 50 students. Prerequisite: AN SC 300 or equivalent. Offered alternate years. Next offered fall 2001, 2003; not offered fall 2002. Lecs, R 2:30–4:25. J. E. Parks.
Study of the formation, growth, differentiation, and maturation of mammalian sperm and oocytes; gamete transport and interaction with male and female reproductive tracts; and cytological, physiological, and molecular changes required for fertilization. Lecture, discussion, and aspects of gamete physiology and *in vitro* technologies such as cryopreservation, oocyte maturation, and fertilization are covered.

AN SC 427 Fundamentals of Endocrinology (also BIOAP 427)
Fall. 3 credits. Prerequisite: animal or human physiology or permission of instructor. Lecs, M W F 9:05. P. A. Johnson.
Physiology and regulation of endocrine secretions. Neuroendocrine, reproductive, growth, and metabolic aspects of endocrinology are emphasized. Examples are selected from many animals, including humans.

AN SC 456 Dairy Management Fellowship
Spring. 2 credits. Limited to seniors. Prerequisites: AN SC 351 and 355, and permission of instructor. S-U grades only. Hours TBA. D. M. Galton and T. Batchelder.
The program is designed for undergraduates who have a sincere interest in dairy farm management. Objective is to gain further understanding of the integration and application of dairy farm management principles and programs with respect to progressive dairying and related industries.

AN SC 494 Special Topics in Animal Science
Fall or spring. 4 credits maximum. Prerequisite: undergraduate standing. S-U grades optional. Staff.
The department teaches "trial" courses under this number. Offerings vary by semester and are advertised by the department before the semester begins. Courses offered under the number will be approved by the department curriculum committee, and the same course is not offered more than twice under this number.

AN SC 495 Introduction to Research
Fall. 1 credit. S-U grades only. Required of students undertaking Honors in Animal Science. Open to Honors students in other programs and those planning to pursue research, by permission of the instructor. Disc, M 12:20–1:10. W. B. Currie.
An exposure to the world of scientific research including: identifying problems; devising hypotheses and realistic research plans; evaluating scientific writings and other forms of communication; finding and managing reference materials; examining the cost of research and opportunities for funding; discussing the obligations imposed on investigators by society and a host of regulatory agencies, along with responsibilities and freedom in science; and considering ethical issues that affect scientists. Students make oral presentations and prepare brief items of technical writing.

AN SC 496 Internship in Animal Science
Fall or spring. 1–3 credits; limited to 6 credits maximum during undergraduate career. Students must register with an Independent Study form (available in 140 Roberts Hall). S-U grades only. Staff.
Structured, on-the-job learning experience under supervision of qualified professionals in a cooperating organization (e.g., farm, agribusiness, pharmaceutical company, zoo, educational institution). Internships must be approved in advance by the student's academic adviser and must provide an acceptable, professionally supervised experience of at least 60 hours on the job per credit required.

AN SC 497 Individual Study in Animal Science
Fall or spring. 1–3 credits; may be repeated for credit. Intended for students in animal sciences. Prerequisite: permission of instructor. Students must register with an Independent Study form (available in 140 Roberts Hall). S-U grades optional. Staff.
May include individual tutorial study or a lecture topic selected by a professor. Since topics may change, the course may be repeated for credit.

AN SC 498 Undergraduate Teaching
Fall or spring. 1, 2, or 3 credits; limited to 2 experiences during undergraduate career. Limited to students with a GPA of at least 2.7. Students must register with an Independent Study form (available in 140 Roberts Hall).
Designed to consolidate the student's knowledge. A participating student assists in teaching a course allied with the student's education and experience. The student is expected to meet regularly with a discussion or laboratory section, to gain teaching experience, and regularly to discuss teaching objectives, techniques, and subject matter with the professor in charge.

AN SC 499 Undergraduate Research
Fall or spring. 6 credits maximum during undergraduate career. Not open to students who have earned 6 or more undergraduate research credits elsewhere in the college. Limited to juniors and seniors with a GPA of at least 2.7. Students must register with an Independent Study form (available in 140 Roberts Hall).
Affords opportunities for students to carry out independent research under appropriate supervision. Each student is expected to review pertinent literature, prepare a project outline, conduct the research, and prepare a report.

[AN SC 601 Amino Acids (also NS 601)
Spring. 2 credits. Prerequisites: physiology, biochemistry, and nutrition. Lecs, W F 12:20. Offered alternate years. Next offered spring 2003; not offered spring 2002, 2004. R. E. Austic.
A course emphasizing the dynamic aspects of protein digestion and absorption, amino acid transport and amino acid and nitrogen metabolism, and their relationships to the nutritional requirements for amino acids.]

[AN SC 603 Mineral Nutrition: Metabolic, Health, and Environmental Aspects (also NS 603)
Fall. 2 credits. Prerequisites: biochemistry, physiology, and nutrition. Lec T 2:20–4:25. Offered alternate years. Next offered fall 2002; not offered fall 2001, 2003. X. G. Lei and G. F. Combs, Jr.
This course focuses on the metabolic roles and environmental impacts of mineral nutrition in animal, human, and food systems. Team-taught lectures include general biochemical and physiological aspects of mineral metabolism and specific mechanisms of gene expression, regulation, and mammal health disorders associated with individual elements.]

AN SC 604 Vitamins (also NS 604)
Fall. 2 credits. Lec, T R 10:10. G. F. Combs, Jr.
For description, see NS 604.

AN SC 606 Ruminant Nutrition: Microbial Ecology and Forage Chemistry
Spring. 4 credits. Prerequisites: Animal Science 212, Biochemistry. S-U grades optional. Lecs, M W F 9:05; disc, W 8:00. Offered alternate years. Next offered spring 2002, 2004; not offered spring 2003. A. N. Pell.
This course provides an overview of ruminant nutrition with an emphasis on microbial ecology, forage chemistry, and rumen function.

AN SC 610 Animal Science Seminar
Fall and spring. 1 credit. Registration limited to graduate students. S-U grades only. Lec T 12:20–1:10. D. J. Cherney.
Students attend a weekly seminar on topics related to animal science. The requirement for an S grade is to regularly attend seminars during the semester.

AN SC 619 Field of Nutrition Seminar (also NS 619)
Fall and spring. No credit. No grades given.
For description, see NS 619.

AN SC 620 Seminar in Animal Breeding
Fall and spring. 1 credit. Limited to graduate students with a major or minor in animal breeding. S-U grades only. Hours TBA. E. J. Pollak.
Seminar on current topics in animal breeding and statistics as applied to genetic evaluation and selection of domestic animals.

AN SC 621 Seminar: Endo/Reprod Biology
Fall and spring. 1 credit. Prerequisites: permission of instructor. Registration limited to graduate students. S-U grades only. Lec, W 4:00. W. R. Butler and staff.
Current research in reproductive physiology is presented by staff members, graduate students, and visitors.

AN SC 625 Nutritional Toxicology (also TOX 625)
Spring. 2 credits. Prerequisites: biochemistry and nutrition courses. S-U grades optional. Lec, W 1:25–2:15; lab/disc, W 2:30–4:25. D. L. Brown.
Exploration of toxicological principles and a selective survey of natural food and feed toxicants. At the end of this course, students understand relationships between nutrition and toxicology; are prepared to conduct research concerning the effects of naturally occurring toxicants; and are able to use multimedia to present their understanding of a class of toxicants. Occasionally, the class takes walking field trips. In addition, students read printed and electronic communications and create STELLA simulation models and a system of web pages related to a specific family of toxicants.

[AN SC 630 Bioenergetics/Nutritional Physiology
Spring. 3 credits. Prerequisites: AN SC 410 and biochemistry or physiology, or permission of instructor. S-U grades optional. Offered alternate years. Next offered spring 2003; not offered spring 2002, 2004. Lec, M W F 10:10. A. W. Bell and D. E. Bauman.
An integrated systems approach to the nutritional physiology and energy metabolism of productive animals. Emphasis on extracellular regulation of tissue and organ metabolism of specific nutrients in relation to pregnancy, lactation, and growth. Critical discussion of techniques and approaches to the study of animal bioenergetics.]

AN SC 640 Individual Study in Animal Science
Fall or spring. 1 or more credits. S-U grades optional. Hours TBA. Staff.
Study of topics in animal science more advanced than, or different from, other courses. Subject matter depends on interests of students and availability of staff.

AN SC 650 Molecular Techniques for Animal Biologists
Spring. 4 credits. Prerequisites: BIOBM 330 or BIOBM 332 or BIOBM 333 or equivalents and permission of instructors. Enrollment limited to 15 students. Offered alternate years. Next offered spring 2002, 2004; not offered spring 2003. Lec, T 11:15; labs, T and R 1:25–4:25. Y. Boisclair and S. Quirk.
A laboratory course designed for students with little or no experience with techniques in molecular biology. Emphasis is on modern techniques used in conducting research in animal-related sciences such as nutrition, physiology, pharmacology, and immunology (e.g., subcloning, mutagenesis of DNA, RT-PCR, analysis of gene expression, protein expression). Lectures introduce laboratory exercises and supplement laboratory topics. Students perform an independent project requiring time outside scheduled laboratories and give a scientific presentation.

AN SC 694 Special Topics in Animal Science
Fall or spring. 4 credits maximum. Prerequisite: graduate standing. S-U grades optional.
The department teaches "trial" courses under this number. Offerings vary by semester and are advertised by the department before the semester begins. Courses offered under the number will be approved by the department curriculum committee, and the same course is not offered more than twice under this number.

AN SC 720 Advanced Quantitative Genetics
Spring. 3 credits. Prerequisites: matrix algebra, linear models, and mathematical statistics. S-U grades optional. Offered alternate years. Next offered spring 2002, 2004; not offered spring 2003. Hours TBA. R. L. Quaas.
This course covers statistical methods used in a variety of problems in the quantitative genetics of animal populations. The initial focus is the estimation of breeding values for purposes of ranking animals for selection. The core of the course is the mixed linear model; linear estimators and predictors are treated extensively. The importance of appropriate modeling is emphasized. Generalizations to nonlinear models, via Bayesian principles, are made, i.e., inferences from posterior distributions.

AN SC 800 Master's-Level Thesis Research
Fall or spring. Credit TBA, maximum 12 credits/semester. Prerequisite: permission of adviser. S-U grades only. Graduate faculty.
For students admitted specifically to a Master's program.

AN SC 900 Graduate-Level Thesis Research
Fall or spring. Credit TBA, maximum 12 credits/semester. Prerequisite: permission of adviser. S-U grades only. Graduate faculty.
For students in a Ph.D. program **only before** the "A" exam has been passed.

AN SC 901 Doctoral-Level Thesis Research
Fall or spring. Credit to be arranged, maximum 12 credits/semester. Prerequisite: permission of adviser. S-U grades only. Graduate faculty.

For students admitted to candidacy **after** the "A" exam has been passed.

Related Courses in Other Departments

Introductory Animal Physiology (BIOAP 311)

Introductory Animal Physiology Laboratory (BIOAP 319)

Milk Quality (FOOD 351)

Agriculture in the Developing Nations (INTAG 602)

Lipids (NS 602)

Basic Immunology, Lectures (BIOG 305)

BIOLOGICAL SCIENCES

The program of study in biology is coordinated by the Office of Undergraduate Biology. For course descriptions, see the section on Biological Sciences.

BIOLOGY & SOCIETY

The undergraduate major field of study in biology and society is offered through the Department of Science and Technology Studies. For a full description of courses that fulfill field requirements, see the Biology and Society listing under 'Special Programs and Interdisciplinary Studies' in this publication.

BIOMETRY AND STATISTICS

M. Wells, chair, N. S. Altman, C. Castillo-Chavez, M. Contreras, D. Hiebeler, F. Hu, R. Lloyd, R. Nielsen, S. J. Schwager, R. Strawderman

The Department of Biometrics in Statistical Science offers the following courses in Biometry and Statistics. Students need to register under Course Listings: College of Agriculture and Life Sciences—Biometry and Statistics.

BTRY 100 Statistics and the World We Live In (also STBTRY 100)
Fall. 3 credits. Lecs, M W F 11:15–12:05; sec, M or T 1:25–2:15 or 2:30–3:20. S. J. Schwager.
Major concepts and approaches of statistics are presented at an introductory level. Three broad areas are covered: collecting data, organizing data, and drawing conclusions from data. Topics include: sampling, statistical experimentation and design, measurement, tables, graphs, measures of center and spread, probability, the normal curve, confidence intervals, and statistical tests.

BTRY 101 Introduction to Biometry I
Spring. 4 credits. S-U grades optional. Prerequisites: pre-calculus. Lecs, M W F 11:15–12:05; lab, R or F 8:00–9:55 or 2:30–4:25. D. Hiebeler.
An introductory survey course in the use of mathematics, computing, and probability and statistics in the biological sciences. Case studies are used to develop the ideas of statistics, curve fitting, elementary matrix algebra, basic probability, and differentiation. Selected topics in differential and difference equations and integration are also covered. A symbolic mathematics and graphics package (e.g., Maple or Mathematica) is taught and used throughout the course.

BTRY 102 Introduction to Biometry II
Fall. 4 credits. S-U grades optional. Prerequisite: BTRY 101 or 2 semesters of calculus. Lecs, M W F 11:15–12:05; lab, T 12:20–2:15 or 2:30–4:25. D. Hiebeler.
This course is the continuation of Biometry 101. It provides a more in-depth view of the use of mathematics, computing, and probability and statistics in the biological sciences. Topics covered include: discrete and continuous models, applications of differential and integral calculus, optimization methods, matrix algebra, and Markov models.

BTRY 261 Statistical Methods I (also STBTRY 261)
Fall and summer. 4 credits. Lecs, M W F 12:20–1:10; sec, M or T 1:25–2:15 or 2:30–3:20. R. Lloyd.
Statistical methods are developed and used to analyze data arising from a wide variety of applications. Topics include descriptive statistics, point and interval estimation, hypothesis testing, inference for a single population, comparisons between two populations, one and two-way analysis of variance, analysis of categorical data, and correlation and regression analysis. Interactive computing is introduced through MINITAB statistical software. Emphasis is on basic principles and criteria for selection of statistical techniques. The lectures may co-meet with BTRY 601. Sections, homeworks, and exams are administered separately.

BTRY 302 Statistical Methods II (also STBTRY 302)
Spring. 4 credits. Prerequisite: BTRY 261 or BTRY 601. Limited to undergraduates. Lecs, M W F 11:15–12:05; sec, M 2:30–4:25. R. Lloyd.
A continuation of BTRY 261. Emphasis is on the use of multiple regression analysis, analysis of variance and related techniques to analyze data in a variety of situations. Topics include: least squares estimation; multiple regression; model selection techniques; detection of influential points; goodness-of-fit criteria; principles of experimental design; analysis of variance for a number of designs including multiway factorial, nested, and split plot designs; comparing two or more regression lines; and analysis of covariance. Emphasis is on the appropriate design of studies prior to data collection and the appropriate application and interpretation of statistical techniques. For practical applications, computing is done using the SAS statistical package. The lectures co-meet with BTRY 602. Homeworks and exams are administered separately.

BTRY 400 Biometry Seminar (also STBTRY 400)
Fall and spring. 1 credit. S-U grades only. Prerequisite: BTRY 302, or 409, or 602, or permission of instructor. Sem, R 3:35–4:25. S. J. Schwager.
Students attend a weekly seminar, the Biometrics Unit Discussion Series. Can be taken concurrently with BTRY 600 only with permission of instructor. Students can only take this course twice.

BTRY 408 Theory of Probability (also STBTRY 408)
Fall. 4 credits. Prerequisite: MATH 112, 122, or 192, or permission of instructor. Lecs, M W F 10:10–11:00; sec, M 3:35–5:00. R. Strawderman.
An introduction to probability theory: foundations, combinatorics, random variables and their probability distributions, expectations, generating functions, and limit theory. Biological and statistical applications are the focus. Can serve as either a one-semester introduction to probability or a foundation for a course in the theory of statistics.

BTRY 409 Theory of Statistics (also STBTRY 409)
Spring. 4 credits. Prerequisite: BTRY 408 or equivalent. Lecs, M W F 10:10–11:00; sec, M 3:35–5:00. R. Strawderman.
The concepts developed in BTRY 408 are applied to provide an introduction to the classical theory of parametric statistical inference. Topics include sampling distributions, parameter estimation, hypothesis testing, and linear regression.

BTRY 421 Matrix Computation
Spring. 4 credits. Prerequisite: pre-calculus. Lecs, M W F 9:05–9:55; sec, R 9:05–9:55. M. Contreras.
Introductory course in matrix computations that reviews linear algebra (vector spaces, linear independence) and emphasizes a matrix approach to solving systems (LU-factorization, QR-decomposition, SVD, Schur complements) and the role of the condition number of a matrix. Positive definite matrices, eigenvalues, and their applications in modeling are discussed. Weekly homework assignments and a course project design to teach numerical and statistical simulations in Matlab using the theory of matrices are required.

BTRY 494 Undergraduate Special Topics in Biometry and Statistics (also STBTRY 494)
Fall or spring. 1–3 credits. S-U grades optional.
A course of lectures selected by the faculty. Because topics usually change from year to year, this course may be repeated for credit.

BTRY 495 Statistical Consulting (also STBTRY 495)
Spring. 2 credits. S-U grades only. Limited to undergraduates. Prerequisites or co-requisites: BTRY 302 or 602 and 409 and permission of instructor. Lec, W 1:25–2:15. S. J. Schwager.
Participation in the Department of Biometrics consulting service: faculty-supervised statistical consulting with researchers from other disciplines. Discussion sessions for joint consideration of selected consultations encountered during previous weeks.

BTRY 497 Undergraduate Individual Study in Biometry and Statistics (also STBTRY 497)
Fall and spring 1–3 credits. S-U grades optional. Students must register with an Independent Study form (available in 140 Roberts Hall).
Consists of individual tutorial study selected by the faculty. Because topics usually change from year to year, this course may be repeated for credit.

BTRY 498 Undergraduate Supervised Teaching (also STBTRY 498)
Fall and spring. 2 credits. S-U grades optional. Students must register with an Independent Study form (available in 140 Roberts Hall).
Students assist in teaching a course appropriate to their previous training. Students meet with a discussion or laboratory section and regularly discuss objectives with the course instructor.

BTRY 499 Undergraduate Research (also STBTRY 499)
Fall or spring. 1–3 credits. S-U grades optional. Limited to statistics and biometry undergraduates. Prerequisite: permission of faculty member directing research. Students must register with an Independent Study form (available in 140 Roberts Hall).

BTRY 600 Statistics Seminar (also STBTRY 600)
Fall and spring. 1 credit. S-U grades only. Prerequisite or corequisite: BTRY 409 or permission of instructor. Sem 3:35–4:25. M. Wells.

BTRY 601 Statistical Methods I (also STBTRY 601)
Fall and summer. 4 credits. Limited to graduate students; others by permission of the instructor. Lecs, M W F 12:20–1:10; sec, M or T 2:30–4:00 or 7:30–9:00 P.M. or T 10:10–11:40. R. Lloyd.
Statistical methods are developed and used to analyze data arising from a wide variety of applications. Topics include descriptive statistics, point and interval estimation, hypothesis testing, inference for a single population, comparisons between two populations, one- and two-way analysis of variance, comparisons among population means, analysis of categorical data, and correlation and regression analysis. Interactive computing is introduced through MINITAB statistical software. Emphasis is on basic principles and criteria for selection of statistical techniques.

BTRY 602 Statistical Methods II (also STBTRY 602)
Spring. 4 credits. Limited to graduate students; others by permission of instructor. Prerequisite: BTRY 601 or equivalent. Lecs, M W F 11:15–12:05; sec, M 2:20–4:25 or 7:30–9:25 P.M. or T 12:20–2:15. R. Lloyd.
A continuation of BTRY 601. Emphasis is on the use of multiple regression analysis, analysis of variance, and related techniques to analyze data in a variety of situations. Topics include an introduction to data collection techniques; least squares estimation; multiple regression; model selection techniques; detection of influential points, goodness-of-fit criteria; principles of experimental design; analysis of variance for a number of designs, including multi-way factorial, nested, and split plot designs; comparing two or more regression lines; and analysis of covariance. Emphasis is on appropriate design of studies prior to data collection, and the appropriate application and interpretation of statistical techniques. For practical applications, computing is done with the MINITAB and SAS statistical packages.

[BTRY 603 Statistical Methods III (also STBTRY 603)
Spring. 3 credits. Prerequisite: BTRY 601 and 602 or permission of instructor. Offered alternate years. Next offered spring 2003. Lecs T R 8:40–9:55.
Categorical data analysis, including logistic regression, loglinear models, stratified tables, matched pairs analysis, polytomous response and ordinal data. Applications in biomedical and social sciences.]

BTRY 604 Statistical Methods IV: Applied Design (also STBTRY 604)
Spring. 3 credits. Prerequisites: BTRY 601 and 602 or permission of instructor. Offered alternate years. Not offered spring 2003. Lecs T R 8:40–9:55. F. Hu.
Applications of experimental design including such advanced designs as split plots, incomplete blocks, fractional factorials. Use of the computer for both design and analysis is stressed, with emphasis on solutions of real data problems.

[BTRY 652 Computationally Intensive Statistical Inference (also STBTRY 652)
Spring. 4 credits. S-U grades optional. Prerequisite: BTRY 421 and BTRY 409 or equivalent. Offered alternate years. Not offered spring 2002. Lecs, M W F 2:30–3:20. N. S. Altman.
Modern applications in statistics often require intensive computation not handled by "off-the-shelf" software. This course covers topics in statistical computing including numerical optimization and finding zeros (likelihood and related techniques including generalized estimating equations and robust estimation), kernel density estimation, resampling methods (randomization and bootstrap tests and confidence intervals), and statistical simulation (random number generation, heuristic search methods, Bayesian estimation and Monte Carlo Markov Chain methods for tests and interval estimation). Programming will be done in Matlab. The focus of the course is on the use of numerical analysis methods for solving problems in statistical inference and estimation.]

BTRY 662 Mathematical Ecology (also STBTRY 662)
Fall. 3 credits. S-U grades optional. Prerequisites: a year of calculus and a course in statistics. Lecs, T R 1:25–2:40. C. Castillo-Chavez.
Mathematical and statistical analysis of populations and communities: theory and methods. Spatial and temporal pattern analysis, deterministic and stochastic models of population dynamics. Model formulation, parameter estimation, and simulation and analytical techniques.

[BTRY 672 Topics in Environmental Statistics (also STBTRY 672)
Fall and spring. 2 credits. S-U grades optional. Prerequisite: BTRY 601 or permission of the instructor. Not offered 2001–2002. Lec, R 10:10–11:25. N. S. Altman.
This course is a discussion group focusing on statistical problems arising in the environmental sciences. These issues are explored in a number of different ways, such as student presentations of research papers, directed readings, and outside speakers.]

BTRY 682 Statistical Genomics (also STBTRY 682)
Spring. 4 credits. S-U grades optional. Prerequisite: BTRY 408, BTRY 409, and BIOGD 281, or equivalent or permission of the instructor. Lecs, T R 11:40–12:55; sec, F 12:20–1:10. R. Nielsen.
This course covers topics in the statistical analysis of genetic, molecular and genomic data, including the statistics of DNA database searches and alignment, statistical methods in molecular evolution, population genetics, phylogenetics, molecular ecology, forensic genetics, the analysis of comparative molecular data, QTL mapping, and association mapping. Topics may vary from year to year. All students are expected to participate in small research projects.

BTRY 694 Graduate Special Topics in Biometry and Statistics (also STBTRY 694)
Fall or spring. 1–3 credits. S-U grades optional. A course of lectures selected by the faculty. Because topics usually change from year to year, this course may be repeated for credit.

BTRY 697 Individual Graduate Study in Biometry and Statistics (also STBTRY 697)
Fall, spring, or summer. 1–3 credits. S-U grades optional.
Consists of individual tutorial study selected by the faculty. Because topics usually change from year to year, this course may be repeated for credit.

[BTRY 717 Linear and Generalized Linear Models (also STBTRY 717)
Spring. 3 credits. S-U grades optional. Prerequisites: BTRY 409, BTRY 417, and 602 or equivalents. Offered alternate years. Not offered 2001–2002.
Statistical modeling and inference using linear models and generalized linear models. Estimation by least squares, maximum likelihood, quasi-likelihood, and generalized estimating equations. Covers the use of link functions and generalized linear models to accommodate nonlinear models and non-normally distributed data. Also covers the use of random effects to accommodate correlation structures in both linear mixed models and generalized linear mixed models and to model longitudinal data. Some use of software packages and illustrative examples.]

BTRY 795 Statistical Consulting (also STBTRY 795)
Spring. 2 credits. S-U grades only. Limited to graduate students. Prerequisite or corequisite: BTRY 602 and BTRY 409 or equivalent. Lec, W 1:25–2:15. S. J. Schwager.
Participation in the Department of Biometrics consulting service: faculty supervised statistical consulting with researchers from other disciplines. Discussion sessions for joint consideration of selected consultations encountered by the services during previous weeks. Since consultations usually change from semester to semester, the course may be repeated for credit.

BTRY 798 Graduate Supervised Teaching (also STBTRY 798)
Fall and spring. 2–4 credits. S-U only. Permission of instructor and chair of special committee plus at least 2 advanced courses in statistics and biometry.
Students assist in teaching a course appropriate to their previous training. Students meet

with a discussion section, prepare course materials, and assist in grading. Credit hours are determined in consultation with the instructor, depending on the level of teaching and the quality of work expected.

BTRY 800 Master's-Level Thesis Research
Fall or spring. Credit TBA. S-U grades only. Limited to candidates for graduate degrees. Prerequisite: permission of the graduate field member concerned.
Research at the M.S. level.

BTRY 900 Graduate-Level Dissertation Research
Fall or spring. Credit TBA. S-U grades only. Limited to candidates for graduate degrees. Prerequisite: permission of the graduate field member concerned.
Research at the Ph.D. level.

BTRY 901 Doctoral-Level Dissertation Research
Fall or spring. Credit TBA. S-U grades only.

COMMUNICATION

R. E. Ostman, chair; K. Berggren, M. Campo, A. P. Chan, R. D. Colle, B. O. Earle, G. Gay, D. A. Grossman, J. Hayman, D. Krikorian, B. Lewenstein, T. M. Russo, C. Scherer, D. Scheufele, J. Shanahan, M. A. Shapiro, R. B. Thompson, L. VanBuskirk, W. B. Ward

Note: class meeting times are accurate at the time of publication. If changes are necessary, the department will provide new information as soon as possible.

COMM 116 Communication in Social Relationships
Spring or summer. 3 credits. Spring: lecs, M W F 1:25–2:15. Staff.
An overview of current knowledge about communication, with particular emphasis on interpersonal communication. Introduction to a wide range of contemporary theories and research about effective communication in contexts such as friendships, small groups, organizations, and health care settings.

COMM 117 Writing about Communication
Spring. 3 credits. Concurrent enrollment in COMM 116 required. T R 10:10–11:25, 11:40–12:55, 1:25–2:40. L. VanBuskirk and staff.
Students develop skill in various writing styles and genres. The class explores communication practices and theories as they are observed and studied in personal and professional contexts. Assignments polish students' ability to gather information, to analyze information, to integrate ideas about communication, and to express those ideas clearly and cogently.

COMM 120 Contemporary Mass Communication
Fall or summer. Lecs, M W F 12:20–1:10. J. Shanahan.
The processes and effects of communication systems. Topics include the evolution of communication media, current knowledge about mediated communication, and the role of communication in contemporary social issues. Discussion sections relate the course topics to students' personal experience. Assignments include case studies, experiential learning exercises, and short papers.

COMM 121 Investigating Communication
Fall. 1 credit. Communication majors only. Students must be enrolled concurrently in COMM 120. Lecs, T 10:10–11:00. J. Shanahan.
An examination of research methods in communication, with particular emphasis on the mass communication process. Lectures and exercises are linked to lectures from COMM 120, providing an introduction to how research about communication is done. This course is required for communication majors.

COMM 191 Topics In Communication
Summer. 1–3 credits. Hours TBA. Staff.
Study of topics in communication at lower-division level. Special emphasis is on topics reflecting the expertise of visiting faculty available in summer session and on topics suitable for entry-level college students.

COMM 201 Oral Communication
Fall, spring, or summer. 3 credits. Each section limited to 20 students (fall and spring) or 15 students (summer). Preference given to sophomores, juniors, and seniors. Fluency in spoken English is assumed. Students missing the first two class meetings without university excuse are dropped so others may register. No student will be added or dropped after the second week of classes. K. Berggren, J. Hayman, T. Russo, R. Thompson, and staff.
Through theory and practice students develop self-confidence and competence in researching, organizing, and presenting material to audiences. Students give four graded speeches, write short papers, perform speaker evaluations, and engage in other speech-related activities.

COMM 203 Argumentation and Debate
Fall or summer. 3 credits. T R 10:10–11:25. J. Hayman.
Students learn the principles of argumentation and debate. Topics emphasize Internet database research, synthesis of collected data, analysis of evidentiary quality, refutation of counter claims, identification of logical fallacies, risk evaluation, framing of issues, and coherent storytelling. Students are prepared to work with a great range of opinion and evidence. The course emphasizes different viewpoints, including those of different cultures. Assumptions are questioned and interrogated.

[COMM 204 Effective Listening
Fall, spring, or summer. 3 credits. Limited to 25 nonfreshman students per section. No students accepted or allowed to drop after the second week of classes. Lec, M 2:55–4:10; sec, W 1:25–2:40, 2:55–4:10; R 1:25–2:40, 2:55–4:10. Not offered 2001–2002. R. Thompson.
Lecture and sections are used to present an analysis of the process of listening, to identify barriers to effective listening, and to develop students' listening skills. Topics include audiology, cultural contexts, intercultural communication, linguistics, therapeutic listening, and critical analysis of information. Students are involved in skill-building exercises and in writing self-analytical papers, as well as attending seminars.]

COMM 230 Visual Communication
Spring. 3 credits. Lec 01, T R 9:05–9:55; lab, T 2:30–4:25; W 10:10–12:05, 12:20–2:15 or 2:30–4:25. C. Scherer.
An introduction to visual communication theory. The course examines how visuals influence our attention, perspectives, and understanding. Examples of visuals drawn from advertising, TV news, documentaries, entertainment movies, print and interactive media are used to develop a theoretical framework for becoming more visually aware and for thinking more critically about how visuals influence us.

COMM 240 Communication Systems and Technologies
Spring. 3 credits. Lec M W 2:55–4:10. A. P. Chan.
An exploration of the nature of communication systems and technologies. Topics include a brief history of communication and information technologies, descriptions of the uses, and impacts of technologies within the social system, and an introduction to electronic message design and construction.

[COMM 250 Newswriting for Newspapers
Fall. 3 credits. Limited to 25 students. Keyboarding ability essential. Students missing first two classes without university excuse will be dropped. Prerequisite: college-level writing course. Lecs, M W 9:05–9:55; labs, R 2:30–4:25 or F 9:05–11:00. Not offered 2001–2002. Staff.
Writing and analyzing news stories. A study of the elements that make news, sources of news, interviewing, writing style and structure, press problems, and press-society relations. Concentration on newswriting as it is practiced by newspapers in the United States. Two writing assignments each week, one done in class, one done out of class.]

COMM 260 Science Writing for Public Information
Fall, spring, or summer. 3 credits. Limited to 25 nonfreshman or graduate students per section. Prerequisite: one college-level writing course. Fall: Lec 01, M W F 9:05–9:55, Lec 02, M W F 10:10–11:00; spring: Lec 01, M W F 9:05–9:55 or Lec 02, M W F 1:25–2:15. Staff.
An intensive course in simplifying scientific and technical material for specific audiences within the general public. Weekly assignments include instructions, descriptions, explanations, and summaries in such formats as the newsletter, brochure, and report. Audience analysis is emphasized. Not oriented to the mass media.

COMM 263 Organizational Writing
Fall, spring, or summer. 3 credits. Limited to 25 junior, senior, or graduate students per section. Prerequisite: any college-level writing course. Lec 01, M W F 10:10–11:00, Lec 02, M W F 11:15–12:05. L. VanBuskirk and staff.
Students write from the point of view of various organizations, including businesses, government agencies, and non-profit organizations. Emphasis is on appropriate representation of the writer's organization, audience analysis, and clear and effective written presentation of detailed content. Assignments include text for web sites, reports, proposals, memoranda, letters, and e-mail.

COMM 272 Principles of Public Relations and Advertising
Summer. 3 credits. Not open to freshmen. Staff.
Survey of the fields of public relations and advertising. Descriptions of organizations, jobs, and functions in the industry. The roles of public relations and advertising in society,

the economic system, and organizations. Psychological and sociological principles as bases for appeals. Strategies for media selection and message execution. Introduction to research and regulation.

COMM 282 Communication Industry Research

Fall. 3 credits. Prerequisite: COMM 116, 120, 121. Lec, M W F 12:20–1:10. D. Scheufele.

Public opinion polls, readership/viewership studies, audience segmentation techniques, and media and message effect evaluation are all widely used in communication industries. This course covers the use of basic research design, measurement, sampling, and simple descriptive statistics in conducting these studies.

COMM 284 Sex, Gender, and Communication

Fall. 3 credits. Not open to freshmen. T R 2:55–4:10. L. VanBuskirk.

The course explores the personal, career, social, and economic implications of gender categories. Topics considered include theories of gender construction, social structures, personal relationships, and gender concerns in the workplace.

COMM 285 Communication in Life Sciences (also S&TS 285)

Spring. 3 credits. M W F 10:10–11:05. Staff.

Environmental problems, public health issues, scientific research—in each of these areas, communication plays a fundamental role. From the mass media to individual conversations, from technical journals to textbooks, from lab notes to the web, communication helps define social issues and research findings. This course examines the institutional and intellectual contexts, processes, and practical constraints on communication in the life sciences.

COMM 301 Business and Professional Speaking

Fall, spring, or summer. 3 credits. Prerequisite: COMM 201. Limited to second term sophomores, juniors, and seniors during fall and spring. Lec, M W 11:15–12:05; sec, T 2:30–4:25; W 1:25–3:20; R 10:10–12:05. B. Earle.

The study and practice of written and oral communication skills used in formal and informal organizations, including interviews, informative and persuasive speeches, reports, and discussions. Students exercise and enhance the organizational, analytical, and presentational skills needed in particular settings suited to their own business and professional careers.

COMM 303 Speech and Debate Practicum

Fall and spring. 2 credits. Limited to 10–15 Program in Speech and Debate members only; permission of instructor and completion of 1-year trial basis. Hours TBA. J. Hayman.

Students learn preparation for practice in CEDA (Cross Examination Debate Association) debate, Lincoln Douglas debate, or individual speaking events. The class is divided into four groups according to level of experience; therefore it may be repeated to a maximum of eight credits.

COMM 330 Communication Technologies and Management of Information

Fall. 3 credits. Prerequisite: COMM 240. T R 10:10–11:25. Staff.

Appropriate use of communication and information technologies can facilitate the coordination, control, and management of information. This course surveys existing theories and practice of information management, integrating insights cutting across communication, economics, management science, and sociology.

COMM 350 Writing for Magazines

Fall, spring, or summer. 3 credits. Prerequisite: any college-level writing course. Limited to 25 juniors, seniors, and graduate students, or others with permission of instructor. No drops after third week. Extensive out-of-class writing assignments. Fall: M 1:25–4:25. W. Ward; spring: lec, T R 8:40–9:55; lab, R 1:25–2:15. Staff.

A course in nonfiction freelance writing for magazines. Intensive fact writing to help students communicate more effectively through the medium of the printed word in magazines. Art and techniques of good writing are studied; magazines in many fields of interest are reviewed. All articles are analyzed and returned to the student to rewrite and submit to a magazine.

COMM 352 Science Writing for the Mass Media (also S&TS 352)

Fall. 3 credits. Not open to freshmen. Limited to 24 students. Prerequisite: 1 college-level writing course. Lecs, M W 9:05; lab, W 12:20–2:15. Staff.

How to write about science, technology, and medicine for the mass media. Discussion topics include accuracy, simplicity, comprehensiveness, risk communication, and the history and social structure of science. Writing assignments focus on writing news and feature stories for newspapers and magazines, with excursions into newsletters, radio, TV, and other media.

[COMM 353 Science Writing Practicum

Spring. 1 credit. Prerequisite: COMM 260, COMM/S&TS 352, ENG. 350 or permission of instructor. Hours TBA. Offered even-numbered years. Not offered 2001–2002. B. Lewenstein.

Students cover the annual meeting of the American Association for the Advancement of Science, held in February each year. Before the meeting, students review science writing techniques and issues. At the meeting, students meet with science writers and attend press conferences and scientific sessions. Students write at least two stories. Students are responsible for all costs of travel, lodging, and meals.]

[COMM 368 Text Editing and Management

Fall. 3 credits. Limited to 25 junior, senior, or graduate students. Prerequisite: COMM 250, 260, 263, 350 or 352. M W F 12:20–1:10. Not offered 2001–2002. Staff.

How to guide a manuscript from draft to presentation. Topics include production, copy editing and design, document management, and editorial decision making. Publications include books, magazines, newsletters, and promotional and educational materials for internal and external use. Appropriate for those who will oversee publications as part of their work.]

COMM 376 Planning Communication Campaigns

Spring. 3 credits. Prerequisites: COMM 282 or equivalent social research course (may be taken concurrently). M W F 9:05–9:55. D. Scheufele.

Overviews theories that guide and influence social change efforts. Research techniques and communication tools used in communication planning and campaign design are reviewed. Class discussion focuses on social change efforts in nutrition and health, rural development, marketing, and the environment. Students work closely with a client in designing a communication campaign.

COMM 380 Independent Honors Research in Social Science

Fall or spring. 1–6 credits. Limited to undergraduates who have met the requirements for the honors program. R. Ostman.

COMM 398 Issues in Teaching Communication

Fall and spring. 1 credit. Prerequisite: must be past or current undergraduate teaching assistant for COMM 201, 204, or 301. Alternate M 7:30–9:10 P.M. K. Berggren.

This seminar brings together novice educators to discuss ideas, experiences, and practice. Integration of theory into actual education efforts is challenging for professional educators. Novice teachers are not aware of their common experiences, much less of a theoretical component to education. In discussions of actual teaching experiences, literature reviews, research reports, textbook chapters, curriculum, and evaluation tools, students examine new ideas and practices. The primary goal of the seminar is to enrich and deepen the novice teaching experience.

COMM 405 Community Service Practicum

Fall and spring. 2 credits. May be repeated for credit. Limited to 10–15 Program in Speech and Debate members; permission of instructor required. Hours TBA. J. Hayman.

Students share their communication talents in structured experiences in which they design and implement a speech or debate project in local schools or the community.

COMM 410 Organizational Behavior and Communication

Fall. 3 credits. Labs limited to 15 junior, senior, or graduate students. Prerequisite: COMM 116 or equivalent. Lec, M W 10:10–11:00; Sec 01, W 2:30–4:25; Sec 02, F 10:10–12:05; Sec 03, F 10:10–12:05; Sec 04, F 12:20–2:15; Sec 05, F 12:20–2:15. D. Krikorian.

Study of management and leadership in formal organizations with emphasis on the psychology of communication between supervisor and employee; examination of formal and informal communication networks, and interpersonal communication in an organizational context. Case studies are analyzed in lab.

[COMM 411 Leadership from a Communication Perspective

Spring. 3 credits. Limited to 30 students. Lec, T R 1:25–2:40. Not offered 2001–2002. Staff.

Leadership is a product of human communication. Leadership competence can be increased by increasing communication competence. Leadership theories, particularly transformational leadership, are studied, and gender/minority responsive leadership is stressed. Practical application includes leadership exercises and observation of leaders.]

[COMM 412 Communication Leadership Lab

Spring. 1 credit. Concurrent enrollment in COMM 411 required. Hours TBA. Not offered 2001–2002. Staff.

This course provides laboratory experience in leadership and the methods used to analyze leadership in an organization. Students take turns serving as a group leader of six to eight students in applying leadership theories to study leadership styles, leader-follower relations, organizational culture, and leadership competencies in an organization.]

COMM 418 Communication and Persuasion

Spring. 3 credits. Limited to juniors and seniors only. Prerequisite: COMM 282 or equivalent social science research methods course; and COMM 116 and 120 or introductory psychology or social psychology. T R 10:10–11:40. M. Campo.

The course focuses on theories of communication's influence on persuasion and attitude change. Students become familiar with a variety of social-psychological theories of attitude change and persuasion. Those theories are also applied to a variety of communication situations including mass communication, advertising, public relations/public information, and interpersonal communication. Lectures concurrent with COMM 618; graduate students should enroll in COMM 618.

COMM 420 Public Opinion and Social Processes

Fall. 3 credits. Limited to juniors and seniors only. Prerequisite: COMM 282 or equivalent social science research methods course. Lec, T R 10:10–11:25. M. Campo.

The course provides an overview of the theoretical and applied literature related to the concept, "public opinion." Students investigate how public opinion is perceived and acted upon by society. Relationships between public opinion, communication, and social psychological variables are examined. Public opinion is studied using current theoretical and practical applications. Analysis and interpretation of public opinion polls and trends in public opinion on specific issues. Lectures concurrent with COMM 620; graduate students should enroll in COMM 620.

[COMM 421 Communication and the Environment

Spring. 3 credits. Lec, T R 11:40–12:55. Offered even-numbered years. Not offered 2001–2002. J. Shanahan.

Students investigate how values, attitudes, social structure, and communication affect public perceptions of environmental risk and public opinion about the environment. A primary focus is mass media's impact in public perceptions of the environment, how the media portray the environment, and discussion of the implications of public consumption of environmental content.]

COMM 422 Psychology of Television (and Beyond)

Fall. 3 credits. Prerequisites: introductory psychology or COMM 120. M W F 12:20–1:10 (one evening mid-semester prelim). M. Shapiro.

A survey of knowledge about the psychological influence of television and other audio-visual communication technologies. Topics may include: the history of concerns about television and movies, who watches television and why, how people understand and mentally process television, how television influences thinking and emotions, the effects of various forms (including entertainment, news, and advertising), the future forms of mass media including multimedia and virtual reality. Lectures concurrent with COMM 622; graduate students should enroll in COMM 622.

COMM 424 Communication in the Developing Nations

Fall. 3 credits. Limited to juniors and seniors. Lec, T 1:25–2:35; lab, T 2:35–4:25. R. Colle.

The role of communication in development programs, particularly in the Third World. Emphasis is on communication interventions in agriculture, health, nutrition, family planning and community development, and especially on methods for designing communication strategies for reaching low-income, rural people. Among the approaches considered are extension, social marketing, and development support communication. Lectures concurrent with COMM 624; graduate students should enroll in COMM 624.

COMM 426 Impact of Communication Technologies

Spring. 3 credits. M W 2:55–4:10. Staff.

Examine emerging technologies of communication, such as computer-based information systems and satellites and their potential for influencing communication processes and social systems. Also examines the impacts of previous communication innovations from cave painting to television. Meets with COMM 626; graduate students should enroll in COMM 626.

COMM 428 Communication Law

Spring. 3 credits. Offered even-numbered years. Limited to junior, senior, and graduate students; others by permission of the instructor. Lec, M W F 11:15–12:05. D. Grossman.

A practical survey of the law governing mass media, primarily for those working in the field. Coverage includes restraints on news gathering and publication, privacy, defamation, copyright, broadcast and cable regulation, access, electronic media, and other issues of current interest.

COMM 429 Legal Issues in Business and Electronic Communication

Spring. 3 credits. Prerequisite: COMM 428. Offered odd-numbered years. M W F 11:15–12:05. D. Grossman.

The increase in commercial use of the Internet and new types of interactive electronic media in business create unique contexts for applying traditional principles of law. This course examines the rights and responsibilities of parties involved in electronic commerce, including information security (guaranteeing confidentiality and effective record-keeping), electronic contracts and EDI, rights in information (copyrights, trade secrets, trademarks, and patents), regulation of information content (pornography and advertising), and regulation of on-line conduct (criminal liability and civil exposure).

COMM 439 Designing for Human Computer Interaction

Fall. 3 credits. Prerequisite: permission of instructor. Lec, T 11:40–12:55; lab 01, T 1:25–2:15, lab 02, R 1:25–2:15. G. Gay.

This course is concerned with key issues of the design of the interaction between computers and people. Students come away from the course with an ability to evaluate solutions to design problems and a familiarity with implementing HCI designs. Lectures concurrent with COMM 639; grad students should enroll in COMM 639.

COMM 440 Computer Mediated Communication: Theory and Practice

Spring. 3 credits. Permission of instructor. Letter grade only. Lec, T 12:20–2:15; lab 01, T 11:15–12:05; lab 02, R 11:15–12:05. G. Gay.

Course focuses on the design of computer interfaces and software from the user's point of view. The goal is to teach user interface designs that "serve human needs" while building feelings of competence, confidence, and satisfaction. Topics include formal models of people and interactions, collaborative design issues, psychological and philosophical design considerations, and cultural and social issues. Lectures concurrent with COMM 640; graduate students should enroll in COMM 640.

COMM 466 Public Communication of Science and Technology (also S&TS 466)

Fall. 3 credits. Limited to 15 students. Prerequisite: COMM 352 or 360, or Engineering 350, or permission of instructor. Offered even numbered years. M W 2:55–4:10. B. Lewenstein.

Explore the structure, meanings, and implications of "public communication of science and technology" (PCST). Examine the contexts in which PCST occurs, look at motivations and constraints of those involved in producing information about science for nonprofessional audiences, analyze the functions of PCST. Tie existing ideas about PCST to general communication research, and learn how to develop new knowledge about PCST. Course format is primarily seminar/discussion.

COMM 476 Communication Fellows Program

Spring. 2 credits. M 2:55–4:10. Prerequisites: permission of instructor; limited to communication seniors selected based on goals and academic preparation. B. O. Earle.

A series of lectures, seminars and guest speakers exploring the planning, evaluation and policy-making process. Includes a three-day trip to a metropolitan area to visit corporate leaders, administrative agencies, and policymakers. Fee of $150.00 charged.

COMM 486 Risk Communication

Spring. 3 credits. T R 1:25–2:15; lab R 2:30–4:25. C. Scherer.

An examination of theory and research related to the communication of scientific information about environmental, agricultural, food, health, and nutritional risks. Course concentrates on social theories related to risk perception and behavior. Case studies involving pesticide residues, waste management, water quality, environmental hazards, and personal health behaviors are examined. Emphasis is placed on understanding, applying, and developing theories of risk communication. Lectures concurrent with COMM 686; graduate students should enroll in COMM 686.

COMM 494 Special Topics in Communication

Fall, spring, or summer. 1–3 credits variable. S-U grades optional. Prerequisite: permission of instructor.

Study of topics in communication not otherwise provided by a department course and determined by the interest of the faculty and students.

COMM 496 Internship

Fall, spring, summer, and intersession. 1–3 credits. Students must apply no later than the spring pre-course enrollment period for a fall internship or the fall pre-course enrollment period for a spring or summer internship. **Prerequisites: limited to communication juniors or seniors, 3.0 average in communication courses, and approval of academic adviser.** S-U grades only.

Structured, on-the-job learning experience under supervision of communication professionals in a cooperating organization. Maximum of six credits total may be earned; no more than three per internship but flexibility allows six for one credit each, three for two credits each, or two for three credits each. Internships must be approved in advance by the student's academic adviser and must be supervised by a communication professional in fields of public relations, advertising, publishing, or broadcasting. Minimum of 60 on-the-job hours per credit required.

COMM 497 Individual Study in Communication

Fall or spring. 1–3 credits; may be repeated to 6 credits with a different supervising faculty member. Prerequisite: 3.0 cumulative average. Students must register with an Independent Study form (available in 140 Roberts Hall).

Individual study under faculty supervision. Work should concentrate on locating, assimilating, synthesizing, and reporting existing knowledge on a selected topic. Attempts to implement this knowledge in a practical application are desirable.

COMM 498 Communication Teaching Experience

Fall or spring. 1–3 credits; may be repeated to 6 credits with different courses. **Limited to juniors and seniors.** Intended for undergraduates desiring classroom teaching experience. Prerequisite: 3.0 cumulative average (2.7 if teaching assistant for a skill development course) and permission of the faculty member who will supervise the work and assign the grade. Students must register with an Independent Study form (available in 140 Roberts Hall).

Periodic meetings with the instructor cover realization of course objectives, evaluation of teaching methods, and student feedback. In addition to aiding with the actual instruction, each student prepares a paper on some aspect of the course.

COMM 499 Independent Research

Fall or spring. 1–3 credits; may be repeated to 6 credits. Limited to seniors and graduate students. Prerequisite: 3.0 cumulative average. Students must register with an Independent Study form (available in 140 Roberts Hall).

Permits outstanding students to conduct laboratory or field research in communication under appropriate faculty supervision. The research should be scientific: systematic, controlled, empirical. Research goals should include description, prediction, explanation, or policy orientation and should generate new knowledge.

COMM 510 Organizational Behavior and Communication

Fall. 3 credits. Lec, M W 10:10–11:00; sec, TBA. D. Krikorian.

Study of management and leadership in formal organizations with emphasis on the psychology of communication between supervisor and employee; examination of formal and informal communication networks, and interpersonal communciation in an organizational context. Case studies analyzed in lab. Lectures concurrent with COMM 410; graduate students should enroll in COMM 510.

COMM 610 Seminar in Organizational Communication

Spring. 3 credits. Prerequisites: COMM 410/510 or one course in organizational behavior or permission of instructor. Lec, M W 11:15–12:05; lab, F 10:10–12:05. D. Krikorian.

Examination of contemporary research on the social psychology of interpersonal communication in organizations including supervisor-employee relations, leadership style, work motivation, organizational socialization, and formal and informal communication networks.

COMM 618 Communication and Persuasion

Spring. 3 credits. Prerequisite: introductory research methods course and introductory psychology or social psychology course. T R 10:10–11:40. M. Campo.

The course focuses on theories of communication's influence on persuasion and attitude change. Students become familiar with a variety of social-psychological theories of attitude change and persuasion. Those theories are also applied to a variety of communication situations including mass communication, advertising, public relations/public information, and interpersonal communication. Lectures concurrent with COMM 418; graduate students should enroll in COMM 618.

COMM 620 Public Opinion and Social Processes

Fall. 3 credits. T R 10:10–11:25. M. Campo.

The course provides an overview of the theoretical and applied literature related to the concept "public opinion." Students investigate how public opinion is perceived and acted upon by society. Relationships between public opinion, communcation, and social psychological variables are examined. Public opinion is studied using current theoretical and practical applications. Analysis and interpretation of public opinion polls and trends in public opinion on specific issues. Lectures concurrent with COMM 420; graduate students should enroll in COMM 620.

COMM 622 Psychology of Television (and Beyond)

Fall. 3 credits. Prerequisites: introductory psychology or social psychology and introductory research-methods course. M W F 12:20–1:10. M. Shapiro.

A survey of knowledge about the psychological influence of television and other audio-visual communication technologies. Topics may include: the history of concerns about television and movies, who watches television and why, how people understand and mentally process television, how television influences thinking and emotions, the effects of various forms (including entertainment, news, and advertising), the future forms of mass media including multimedia and virtual reality. Lectures concurrent with COMM 422; graduate students should enroll in COMM 622.

COMM 624 Communication in the Developing Nations

Fall. 3 credits. Open to juniors, seniors, and graduate students. Lec, T 1:25–2:35; lab, T 2:35–4:25. R. D. Colle.

The role of communication in development programs, particularly in Third World nations. Emphasis is on communication interventions in agriculture, health, nutrition, family planning and community development, and especially on methods for designing communication strategies for reaching low-income, rural people. Among the approaches considered are extension, social marketing, and development support communication. Lectures concurrent with COMM 424; graduate students should enroll in COMM 624.

COMM 626 Impact of Communication Technologies

Spring. 3 credits. Open to seniors. M W 2:55–4:10. Staff.

Examines emerging technologies of communication, such as computer-based information systems and satellites and their potential for influencing communication processes and social systems. Also examines the impacts of previous communication innovations from cave painting to television. Meets with COMM 426; graduate students enroll in COMM 626.

COMM 639 Designing for Human Computer Interaction

Fall. 3 credits. Prerequisite: permission of instructor. Lec, T 11:40–12:55; lab 01, T 1:25–2:15; lab 02, R 1:25–2:15. G. Gay.

This course is concerned with key issues of the design of the interaction between computers and people. Students come away from the course with an ability to evaluate solutions to design problems and a familiarity with implementing HCI designs. Lectures concurrent with COMM 439; grad students should enroll in COMM 639.

COMM 640 Computer Mediated Communication: Theory and Practice

Spring. 3 credits. Prerequisite: permission of instructor. Lec, T 12:20–2:15; lab 01, T 11:15–12:05; lab 02, R 11:15–12:05. G. Gay.

Course focuses on the design of computer interfaces and software from the user's point of view. The goal is to teach user interface designs that "serve human needs" while building feelings of competence, confidence, and satisfaction. Topics include formal models of people and interactions, collaborative design issues, psychological and philosophical design considerations, and cultural and social issues. Lectures concurrent with COMM 440; graduate students should enroll in COMM 640.

COMM 641 Human-Computer Interaction

Spring. 3 credits. Offered odd-numbered years. T R 8:40–9:55. G. Gay.

An examination of how people relate to, think about, and think with new communication technologies in schools, homes, and the workplace. Using assigned readings from multiple disciplines, class exercises, field studies, and case studies, students study and critique aspects of human-computer interaction, social psychology, and other issues that shape the process and effectiveness of designing, implementing, and using computer systems.

[COMM 676 Communication Planning for Social and Behavioral Change
Spring. 3 credits. T R 10:10–11:25. Not offered 2001–2002. Staff.
Overview theories that guide and influence social change efforts. Research techniques and communication tools used in communication planning and campaign techniques and communication tools used in communication planning and campaign design are reviewed. Class discussion focuses on social change efforts in nutrition and health, rural development, marketing, and the environment. Course seeks to integrate theory, data-based generalizations, and planning processes into a comprehensive communication plan.]

COMM 680 Studies in Communication
Fall. 3 credits. Limited to graduate students in communication; others by permission of instructor. M W 8:40–9:55. J. Shanahan.
A review of classical and contemporary readings in communication, including key concepts and areas of investigation. An exploration of the scope of the field, the interrelationships of its various branches, and an examination of the role of theory in the research process.

COMM 681 Advanced Communication Theory
Spring. 4 credits. Prerequisite: COMM 680 or graduate standing and permission of instructor. M W 2:55–4:10 with additional meetings TBA. Staff.
Development of, and contemporary issues in, communication theory. Discussion includes the interaction between communication and society, social groupings, and mental processing.

COMM 682 Methods of Communication Research
Spring. 3 credits. Lec, M W 12:20–1:10; sec, F 12:20–2:15. Staff.
An analysis of the methods used in communication research. Emphasis is on understanding the rationale for survey, textual, experimental, and ethnographic research methods. Development of class research project from research question to final report. Computer use of Statistical Package for the Social Sciences (SPSS) to assist in data analysis. Familiarity with basic statistical concepts helpful.

[COMM 683 Quantitative Research Methods in Communication
Spring. 3 credits. Prerequisite: COMM 682 or equivalent. Lec, M 6:00–9:00 P.M. Not offered 2001–2002. Staff.
Experience in quantitative research techniques. The course provides an introduction to inter- and multi-disciplinary research through examination of the procedures, techniques, and assumptions associated with particular techniques of design and measurement, data collection, data preparation, data analysis, and hypothesis testing. Readings include a variety of fields and disciplines in the social and natural sciences.]

[COMM 685 Training and Development: Theory and Practice (also International Agriculture 685 and EDUC 685)
Spring. 4 credits. S-U grades optional. Charge for materials, $45. F 9:05–12:05; lab TBA. Not offered 2001–2002. Staff.
Analysis, design, conduct, administration, and evaluation of training programs for the development of human resources in small-farm agriculture, rural health and nutrition, literacy and nonformal education, and general community development. Design for scientists, administrators, educator-trainers, and social organizers in rural and agricultural development programs in the United States and abroad.]

COMM 686 Risk Communication
Spring. 3 credits. T R 1:25–2:15, lab R 2:30–4:25. C. Scherer.
An examination of theory and research related to the communication of scientific information about environmental, agricultural, food, health, and nutritional risks. Course concentrates on social theories related to risk perception and behavior. Case studies involving pesticide residues, waste management, water quality, environmental hazards, and personal health behaviors are examined. Emphasis is placed on understanding, applying, and developing theories of risk communication. Lectures concurrent with COMM 486; graduate students should enroll in COMM 686.

COMM 691 Seminar: Topics in Communication
Fall and spring. No credit. S-U grades only. Hours TBA. Staff.
Some weeks scholars from a wide variety of fields present varied topics in theory or research as it relates to communication; other weeks graduate students present thesis (project) proposals to faculty and peers.

COMM 694 Special Topics in Communication
Fall, spring, or summer. 1–3 credits variable. S-U grades optional. Prerequisite: permission of instructor. Hours TBA. Staff.
Study of topics in communication not otherwise provided by a department course and determined by the interest of the faculty and students.

COMM 700 MPS Project Research
Fall or spring. 1–6 credits. May be repeated for a maximum of 6 credits. S-U grades only. Prerequisite: permission of committee chair.
Project research for Master of Professional Studies (Communication) students.

[COMM 781 Seminar in Psychology of Communication
Spring. 3 credits. Letter grade. Offered odd-numbered years. Prerequisite: COMM 680 and 681 or equivalent graduate level theory in psychology or social psychology. Hours TBA. Not offered 2001–2002. M. Shapiro.
Discussion and analysis of selected current issues in the psychology of communication. Students discuss and synthesize current research and theory in the mental processing of communication.]

COMM 794 Seminar in Communication Issues
Fall, spring, or summer. 1–3 credits. Letter grade only. Prerequisite: permission of instructor.
Small group study of topical issue(s) in communication not otherwise examined in a graduate field course.

COMM 797 Graduate Independent Study
Fall, spring, or summer. 1–3 credits. Letter grade only. Prerequisite: permission of instructor.
Individual study concentrating on locating, assimilating, synthesizing, and reporting existing knowledge on a selected topic.

COMM 798 Communication Teaching Laboratory
Fall and spring. 1–3 credits each semester. Letter grade only. May be repeated once. Limited to graduate students. Prerequisite: permission of the faculty member who will supervise the work and assign the grade. Students must use the faculty member's section number to register. Graduate faculty.
Designed primarily for graduate students who want experience in teaching communication courses. Students work with an instructor in developing course objectives and philosophy, planning, and teaching.

COMM 799 Graduate Research
Fall, spring, or summer. 1–3 credits. Letter grade only. Prerequisite: appropriate communication graduate course work or permission of instructor.
Small-group or individual research based on original, empirical, data-based designs regarding topical issues in communication not otherwise examined in a graduate field course.

COMM 800 Master's-Level Thesis Research
Fall or spring. 1–6 credits. May be repeated for a maximum of 6 credits. S-U grades only. Prerequisite: permission of committee chair.
Thesis research for Master of Science (Communication) students.

COMM 901 Doctoral-Level Dissertation Research
Fall or spring. 1–9 credits. May be repeated for a maximum of 9 credits. S-U grades only. Prerequisites: completion of "A" exam; permission of committee chair.
Dissertation research for doctoral candidates.

CROP AND SOIL SCIENCES

S. D. DeGloria, chair; M. Alexander, P. C. Baveye, D. R. Bouldin, R. B. Bryant, J. H. Cherney, A. Comis, W. J. Cox, A. DiTommaso, J. M. Duxbury, E. C. Fernandes, G. W. Fick, D. L. Grunes, R. R. Hahn, S. D. Klausner, Q. Ketterings, L. V. Kochian, T. A. LaRue, J. Lehmann, M. B. McBride, J. Mt. Pleasant, R. L. Obendorf, W. D. Pardee, W. S. Reid, S. J. Riha, T. W. Scott, T. L. Setter, P. L. Steponkus, J. E. Thies, H. M. van Es, A. Van Wambeke, R. M. Welch

Note: class meeting times are accurate at the time of publication. If changes are necessary, the department will provide new information as soon as possible.

Courses by Subject

Crop Science: 311, 312, 314, 315, 317, 455, 608, 610, 612, 613, 614, 642, 691, 820, 920, 921

Environmental Information Science: 398, 411, 420, 465, 620, 660, 675, 694, 860, 960, 961

Soil Science: 260, 321, 362, 363, 365, 366, 372, 373, 471, 473, 483, 663, 666, 667, 669, 671, 693, 880, 980, 981

All following Crop and Soil Sciences course prefixes were previously listed as SCAS.

General Courses

CSS 190 Sustainable Agriculture
Fall. Credits variable, 2 or 3. Limited to 60 students. S-U grades optional. Lec, R 10:10; labs, M T 2:00–4:25. G. W. Fick.
This course is designed to be an enjoyable introduction to basic food production resources (soils, crops, and climates), and it emphasizes scientific principals of management that conserve or renew those resources for continuing benefit to society. The information is of general value for nonmajors and students new to the field. Laboratories include several field trips and stress hands-on experience with soils, crops, and descriptive climatology. Written assignments are prepared for the web. Extra credit can be earned by participation in team preparation and delivery of a lesson in sustainable agriculture.

CSS 494 Special Topics in Crop and Soil Sciences (undergraduate level)
Fall or spring. 4 credits maximum. S-U grades optional.
The department teaches "trial" courses under this number. Offerings vary by semester, and are advertised by the department before the semester begins. Courses offered under this number will be approved by the department curriculum committee, and the same course is not offered more than twice under this number.

CSS 497 Individual Study in Crop and Soil Sciences
Fall or spring. 1–6 credits. S-U grades optional. Students must register with an Independent Study form (available in 140 Roberts Hall).
The topics in soil science, crop science, or environmental information science are arranged at the beginning of the term for individual study or for group discussions.

CSS 498 Teaching Experience in Crop and Soil Sciences
Fall or spring. 1–5 credits. Students must register with an Independent Study form (available in 140 Roberts Hall). S-U grades optional.
Teaching experience in soil science, crop science, or environmental information science is obtained by assisting in the instruction of a departmental course.

CSS 499 Undergraduate Research
Fall or spring. Credit TBA. Students must register with an Independent Study form (available in 140 Roberts Hall).
Independent research on current problems selected from any phase of crop science or soil science.

CSS 695 Planning and Reporting Research
Spring. 2 credits. First meeting the first T of the semester in 102 Bradfield. G. W. Fick.
New graduate students and students starting to write their theses have found this course very helpful. Topics covered include scientific writing, reviewing, seminar presentations, and poster presentations. The nature of science and the scientific method are also discussed along with professional ethics in the conduct and communication of science.

CSS 696 Seminar in Crop and Soil Sciences
Fall and spring. 1 credit. S-U grades only. Lec, T 3:30–4:30. Staff.
Current research and selected topics in the crop and soil sciences and related fields.

Crop Science

CSS 311 Grains and Nutriceuticals
Fall. 4 credits. Prerequisite: CSS 260 or BIOPL 241. Lecs, M W F 10:10; lab, M 1:25–4:25. 1 or 2 field trips during lab periods (until 5 P.M. or on weekends). R. L. Obendorf.
Globally, six seed crops provide 75 percent of the caloric and protein needs of mankind by direct consumption or indirectly through animal and microbial products. Seed crops for starch, protein, oil, fiber, sugar, nutriceutical, pharmaceutical, and industrial uses are emphasized, including adaptation, growth and development, environmental stress, optimization of yield and quality, and genetic improvement in the context of food systems for improved health. Laboratory uses living plants, extensive crop garden, and computer simulation.

[CSS 312 Forage Crops
Spring. 4 credits. Prerequisites: introductory course in crop and/or soil science. Recommended: course in animal nutrition. Lecs, M W F 11:15; lab, T or W 1:25–4:25. Not offered spring 2002. G. W. Fick.
The production and management of crops used for livestock feed are considered in terms of establishment, growth, maintenance, harvesting, and preservation. Forage grasses, forage legumes, and corn are emphasized, and consideration is given to their value as livestock feed in terms of energy, protein, and other nutritional components.]

CSS 314 Tropical Cropping Systems: Biodiversity, Social, and Environmental Impacts (also INTAG 314)
Fall. 3 credits. Prerequisite: an introductory course in crop science or soil science or biology or permission of instructor. Lec, T R 8:40–9:55. E. C. Fernandes.
Characterization and discussion of: traditional shifting cultivation; lowland rice-based systems; upland cereal-based systems; smallholder mixed farming including root crops and livestock; plantation fruit and oil crop systems; and agroforestry. In addition to species diversity and domestication, factors such as climate, land quality, soil management, land tenure, labor, and markets are considered. The impact of tropical cropping systems on the environment are evaluated.

CSS 315 Weed Science
Fall. 4 credits. Prerequisite: introductory course in biology or botany. Lecs, T R 10:10–11:25; lab, T or W 2–4:25. A. DiTommaso.
Principles of weed science are examined. Emphasis is on: (a) weed biology and ecology; (b) chemistry of herbicides in relation to effects on plant growth and the environment; and (c) current management strategies that are relevant to both crop and noncrop ecosystems. Hands-on laboratory sessions cover weed identification and ecology, and herbicide selectivity and symptomology.

CSS 317 Seed Science and Technology (also HORT 317)
Fall. 3 credits. Prerequisite: BIOPL 241 or equivalent. Lecs, T R 11:40–12:30; lab, R 1:25–4:25. 2 all-day field trips will be scheduled during the semester. Offered alternate years. A. G. Taylor, Geneva Experiment Station. (Ithaca contact, R. L. Obendorf.)
The principles and practices involved in the production, harvesting, processing, storage, testing, quality management, certification, and use of high-quality seed from improved cultivars. Information is applicable to various kinds of agricultural seeds. Hands-on laboratory experience.

CSS 415 Principles and Practices of Agroforestry (also NTRES 415 and HORT 415)
Fall. 3 credits. Prerequisites: senior or graduate standing or permission of instructor. S-U option. Lec, M W F 10:10–11:00. Optional laboratory, CSS [SCAS] 416 (also NTRES 416 and HORT 416). E. Fernandes, K. Mudge, L. Buck, J. Lassoie.
An introduction to modern and traditional agroforestry systems which involves spatial or temporal integration of multipurpose woody plants (trees and/or shrubs) with annual or perennial crops and/or with livestock. Interactions between woody and nonwoody components of agroforestry systems are considered, based on above and below ground processes. The sustainability of agroforestry systems is critically examined from biophysical, socio-economic, and policy perspectives.

CSS 416 Principles and Practices of Agroforesty—Laboratory (also NTRES 416 and HORT 416)
Fall. 1 credit. Optional lab component of HORT 415 (also NTRES and CCS [SCAS]). S-U grades optional. Prerequisites: junior, senior, or graduate standing or permission of instructor; prior or concurrent enrollment in HORT 415. W 1:25–4:25. K. Mudge, E. Fernandes, L. Buck, J. Lassoie.
An integrated set of laboratory and field exercises designed to develop competency in diagnostic and management skills applied to agroforestry practice. Sessions include field trips to local practitioners as well as working demonstration farms and forests, case study design and analysis, use of computer-based sources of information, and practical skills with woody plants including identification, propagation, planting, pruning, and measurement.

CSS 455 Mineral Nutrition of Crops and Landscape Plants (also HORT 455)
Spring. 3–5 credits. Prerequisite: CSS 260 and BIOPL 242, or equivalent. Lecs, M W F 9:05; lab, R 1:30–4:00. Offered alternate years. H. C. Wien and staff.
A modular course on principles of plant mineral nutrition and nutrient management. A mandatory module on principles is followed by others on agronomic crops, vegetables, floriculture, and fruit crops. Each module carries one credit; a minimum of three credits must be taken in one semester. By the end of the course, students understand the principles of mineral nutrient function in crop plants, are able to diagnose deficiencies by symptoms and tissue tests, and devise organic and conventional nutrient management schemes that maximize productivity and mineral nutrient quality.

CSS 608 Water Status in Plants and Soils
Fall. 1 credit. Prerequisite: permission of instructor. S-U grades only. Lec, 1 hour TBA; lab, first class meeting R 1:25–4:25. Offered alternate years. T. L. Setter.
Covers techniques for field appraisal of the status of water in plants and soil, including methods used in physiological studies, such as the psychrometer, pressure chamber, gas exchange analyzer, and abscisic acid analysis with ELISA.

CSS 610 Physiology of Environmental Stresses
Spring. 3 credits. Prerequisite: BIOPL 242 or 341. Lecs, T R 10:10–11:25. Offered alternate years. P. L. Steponkus.
A study of the responses of plants to environmental stresses, with emphasis on thermal stresses including chilling, freezing, and high temperature injury. Emphasis is on the physiological and biochemical basis of injury and plant resistance mechanisms at the whole-plant, cellular, and molecular levels.

CSS 612 Seed Physiology and Biotechnology
Spring. 3 credits. Prerequisite: plant physiology. T R 8:30–9:55. R. L. Obendorf.
This course in seed biology describes the molecular, biochemical, physiological, environmental, and genetic regulation of seed development, maturation, and germination events including the deposition and mobilization of seed reserves with illustrations from the world's major food and feed seeds. Illustrations extend the principles to practical situations, industrial uses, and food systems for improved health.

CSS 613 Physiology and Ecology of Yield
Spring. 3 credits. Prerequisite: plant physiology. M W F 12:20. T. L. Setter.
A study of environmental constraints on crop-plant productivity from a physiological perspective. Acclimation responses and genetic adaptation are examined for temperature, light, water, compacted soil, and mineral nutrient environments. Topics include: photosynthesis and nitrogen assimilation, translocation, and partitioning; canopy-scale influences on solar radiation use efficiency; regulation of growth processes in leaf, root, and floral sinks in response to environment; seed set; water transport and stomatal regulation; root growth in flooded and compacted soils; and drought responses. Emphasis is on growth processes of vegetative plant organs.

[CSS 614 Weed Ecology and Management
Spring. 3 credits. Prerequisite: CSS 315 or equivalent. Lec, T R 10:10–11:25. Offered alternate years. Next offered spring 2003. A. DiTommaso.
An examination of plant ecological principles governing weed population dynamics and weed-crop competitive interactions in different crop and noncrop ecosystems. Application of these fundamentals for the development and implementation of environmentally sound and sustainable integrated weed management strategies is explored. Topics include seed biology and seedbank dynamics, weed demography and spatial variation, weed-crop interferences, bio-economic weed thresholds, and site-specific weed management.]

[CSS 642 Plant Mineral Nutrition (also BIO PL 642)
Spring. 3 credits. Prerequisite: BIO PL 341 or equivalent. Lecs, M W F 10:10–11. Offered alternate years. L. V. Kochian, R. M. Welch.
A detailed study of the processes by which plants acquire and utilize mineral nutrients from the soil. Topics include the uptake, translocation, and compartmentation of mineral elements; root-soil interactions; metabolism of mineral elements; the involvement of mineral nutrients in various physiological processes; and nutrition of plants adapted to extreme environmental stresses (e.g., acid soils). Specific mineral elements are emphasized to illustrate the above topics.]

CSS 691 Special Topics in Crop Science
Fall or spring. 1–6 credits. S-U grades optional. Hours TBA. Staff.
Study of topics in crop science that are more specialized or different from other courses. Special topics to be offered depend on staff and student interests.

CSS 820 Master's-Level Thesis Research in Crop Science
Fall or spring. Credit by arrangement. S-U grades only. Hours by arrangement. Graduate faculty.
Limited to students specifically in a master's program.

CSS 920 Graduate-Level Thesis Research in Crop Science
Fall or spring. Credit by arrangement. S-U grades only. Hours by arrangement. Graduate faculty.
Limited to students in a Ph.D. program **only before** the "A" exam has been passed.

CSS 921 Doctoral-Level Dissertation Research in Crop Science
Fall or spring. Credit by arrangement. S-U grades only. Hours by arrangement. Graduate faculty.
Limited to students admitted for candidacy **after** the "A" exam has been passed.

Environmental Information Science

CSS 398 Environmental Microbiology (also BIOMI 397)
Fall. 3 credits. Prerequisite: BIOES 261 or BIOMI 290 or CSS (SCAS) 260 or permission of instructor. Lecs, M W F 10:10. W. C. Ghiorse.
The biology, behavior, and function of microorganisms in natural environments are discussed in relation to past and present environmental conditions on Earth. The role of microorganisms in ecologically and environmentally significant processes is also considered through discussion of specific topics such as elemental cycles, nutrient cycling, transformation of pollutant chemicals, wastewater treatment, and environmental biotechnology.

CSS 411 Resource Inventory Methods (also CEE 411)
Spring. 3 credits. Prerequisite: permission of instructor. Lec, M W 9:05–9:55; lab, M R 1:25–4:25. A. Lembo.
A survey of resource inventory methods applied to field-based studies of environmental systems. Laboratory emphasis is on using maps, spatial databases, global positioning systems, and aerospace imagery to discriminate, measure, inventory, and monitor environmental resources.

CSS 420 Geographic Information Systems
Fall. 4 credits. Prerequisite: CSS (SCAS) 411 or permission of instructor. Lecs, T R 9:05–9:55; lab, T 10:10–1:10, M W R F 1:25–4:25. A. Lembo.
Principles and applications of geographic information systems for the characterization and assessment of agronomic and environmental resources. Methods for accessing, updating, analyzing, and mapping spatial data and information are emphasized. Needs assessment, coordinate systems, database design and maintenance, data transformations, and map accuracy assessment are considered.

CSS 465 Global Positioning System
Fall and spring. 1 credit. Prerequisite: CSS 411 or CSS 420, or equivalent, or consent of instructor. Lec, F 1:25–4:25. A. Lembo.
Introduction to navigation-grade GPS instruments used in agricultural and environmental science. Topics include instrument familiarization; field-data collection and processing; real-time and post-differential correction; and GPS-GIS integration.

CSS 620 Spatial Modeling and Analysis
Spring. 3 credits. Prerequisites: CSS (SCAS) 420, CSS (SCAS) 461, or permission of instructor. Lecs, T R 9:05–9:55; lab, T W 1:25–4:25. A. Lembo.
Theory and practice in the development, integration, and visualization of spatial data for resource inventory, environmental process modeling, land classification and evaluation. Application and evaluation of advanced spatial analytical methods applied to environmental systems and databases of interest to the student are emphasized.

CSS 660 Remote Sensing Fundamentals (also CEE 610)
Fall. 3 credits. Prerequisite: permission of instructor. Lecs, M W 12:20–1:10; lab, T 2:30–4:25. W. D. Philpot.
An introduction to equipment and methods used in obtaining information about earth resources and the environment from aircraft or satellite. Coverage includes sensors, sensor and ground-data acquisition, data analysis and interpretation, and project design.

CSS 675 Modeling the Soil-Plant-Atmosphere System (also EAS 675)
Spring. 3 credits. Prerequisite: CSS (SCAS) 483 or equivalent. Offered alternate years. Lecs, T R 8:40–9:55. S. J. Riha.
Introduction to the structure and use of soil-plant-atmosphere models. Topics covered include modeling plant physiology, morphology, and development; potential crop production and crop production limited by moisture and nutrient availability; plant-plant competition; and land surface processes as well as model data requirements, validation and scale. Use of soil-plant-atmosphere models for teaching, research, extension, and policy formation are discussed.

CSS 694 Special Topics in Environmental Information Science
Fall or spring. 1–6 credits. S-U grades optional. Hours TBA. Staff.
Study of topics in environmental science that are more specialized or different from other courses. Special topics to be covered will depend on staff and student interests.

CSS 860 Master's-Level Thesis Research in Environmental Information Science
Fall or spring. Credit by arrangement. S-U grades only. Graduate faculty.
Limited to students specifically in a master's program.

CSS 960 Graduate-Level Dissertation Research in Environmental Information Science
Fall or spring. Credit by arrangement. S-U grades only. Hours by arrangement. Graduate faculty.
Limited to students in a Ph.D. program **only before** the "A" exam has been passed.

CSS 961 Doctoral-Level Dissertation Research in Environmental Information Science
Fall or spring. Credit by arrangement. S-U grades only. Hours by arrangement. Graduate faculty.
Limited to students admitted to candidacy **after** the "A" exam has been passed.

Soil Science

CSS 260 Soil Science (also EAS 260)
Fall. 4 credits. S-U grades optional. Lecs, M W F 9:05; lab, M T W or R 1:25. S. Riha.
Designed for students interested in a comprehensive introduction to soil science from both an environmental and plant management perspective, this course is divided into three units. A unit on soil information introduces students to soil characterization, testing, mapping, classification, GIS, and land evaluation. A soil management unit addresses fertility, pest management, water, and microclimate, as well as erosion, conservation, pollution, and soil health. The unit on the role of soils in ecosystems considers topics such as biodiversity, soils as sinks and sources of greenhouse gases, and the impact of soils on land use. Labs are initially field-oriented with an emphasis on learning practical skills needed to evaluate and manage soils. Subsequent labs focus on accessing, interpreting and applying soil information.

CSS 321 Soil and Water Management
Fall. 4 credits. Prerequisites: CSS (SCAS) 260. S-U grades optional. Lecs, T R 11:40–12:55; lab, R 2:30–4:25. Offered alternate years. H. M. van Es.
Introduces students to the principles of soil and water interaction and to the effects of human intervention on these processes. Aspects of soil and water management, including hydrology, soil erosion and conservation, water management, contaminant movement, tillage, soil compaction, and water quality are examined. Case studies and policy approaches from both the United States and abroad are discussed.

CSS 362 Soil Morphology
Fall. 1 credit. Undergraduates only. Recommended for sophomores and juniors. R 1:25–4:25; all day field trip required. R. B. Bryant.
The principles for field identification of soil properties, profiles, and landscapes are presented. A series of soil pits are examined, described, classified, and interpreted in the field.

CSS 363 Soil Genesis, Classification, and Survey
Fall. 4 credits. Prerequisite: CSS (SCAS) 260. Lecs, M W F 11:15; lab, W 1:25–4:25. 1 all day field trip is required. R. B. Bryant.
Factors and processes of soil formation on which soil survey is based are discussed. Principles of field identification, classification, survey, and interpretation are practiced in a field setting. An overview of soil databases, their content, development, and use for site evaluation and land classification is provided.

CSS 365 Environmental Chemistry: Soil, Air, and Water
Spring. 3 credits. Prerequisites: CHEM 207–208. Lecs, M W F 10:10–11:00. M. B. McBride.
An overview of the chemical processes that control the concentrations and bioavailability of nutrients and pollutants in soil, air, and water. Particular attention is given to soil's function as a filter for contaminants. The history of environmental contamination and its impact on agricultural soils and ecosystems is described.

CSS 366 The Soil Ecosystem (also HORT 366)
Spring. 3 or 4 credits. Lecture only, 3 credits; lecture plus lab, 4 credits; lab cannot be taken without lecture. Prerequisite: one year intro biology. Lecs, T R 10:10–11:25; lab, W 1:25–4:25. J. E. Thies, L. E. Drinkwater.
Activities of the soil biota are crucial for the continued functioning and renewal of soil ecosystems. Through study of the soil as an ecosystem, students gain an understanding of the diversity of soil organisms and the critical roles that microbial activities and interactions have in agricultural production and environmental protection. Through a small research project, students also gain competencies in developing research questions and formulating hypotheses, planning appropriate methods for gathering and interpreting data, and summarizing research work.

CSS 372 Nutrient Management in Agro-Ecosystems Soil Fertility Management
Spring. 4 credits. Prerequisite: CSS (SCAS) 260 or permission of instructor. Lec, T R 8:40–9:55; lab, R 1:25–4:25. J. Lehmann.
Students become familiar with the basic concepts of soil fertility, and how soil and environmental properties affect nutrient availability and cycling. Discussion focuses on the way organic farming and soil conservation affect the fate of nutrients in agro-ecosystems. Emphasis is placed on the way nutrient management can be improved without creating environmental hazards. Students have hands-on training in analytical procedures and expand knowledge in discussion groups and through oral as well as poster presentations.

CSS 471 Properties and Appraisal of Soils of the Tropics
Spring. 3 credits. Prerequisite: CSS (SCAS) 260 or equivalent. S-U grades optional. No audits accepted. Offered alternate years. Lecs, T R 12:20; disc, W 1:25–3:25. A. VanWambeke.
The course examines the conditions in which soils form, and considers ecological, geological, and vegetational factors that produce the diversity that exists among them. The major kinds of soils are recognized, their management properties described, and methods to alleviate the constraints to crop production and the preservation of the environment examined. Topics include the identification of soils, and their functions in sustaining traditional farming systems and advanced technological packages. The course pursues these themes reviewing the most recent sources of information generated in tropical countries and published in Latin-American, French, and English journals. The last part of the course gives special attention to salt-affected soils, paddy rice cultivation, and the characteristics of acid-sulfate soils. Lectures include slides of soils, landscapes, and cropping systems.

[CSS 473 Ecology of Agricultural Systems (also BIOEE 473)
Fall. 3 credits. Limited to 45 students. Prerequisite: BIOEE 261 or permission of instructor. S-U grades optional. Lec and disc, T R 2:30–3:45. During the first 6 weeks of class, the Thursday meetings may run to 5:30 because of field trips. Not offered 2001–2002. Next offered fall 2002. A. G. Power and E. C. Fernandes.
Analysis of the ecological processes operating in agricultural systems, with an emphasis on the interactions between organisms. Topics include nutrient dynamics in agroecosystems, plant competition and facilitation, intercropping, the ecology of species invasions, mutualism in agroecoystems, plant-herbivore relations, plant-pathogen interactions, biological pest control, and evolutionary processes in agriculture. Case studies from both the tropics and the temperate zone are used to illustrate important concepts.]

CSS 483 Environmental Biophysics (also EAS 483)
Spring. 3 credits. Prerequisite: CSS (SCAS) 260 or equivalent or permission of instructor. Lecs, M W F 11:15. S. J. Riha.
Introduction to basic principles of energy and mass transfer and storage in soil-plant systems. Energy budgets, soil heat flow, water movement in saturated and unsaturated soils, evapotranspiration, water, gas, and nutrient dynamics in the soil-plant-atmosphere continuum are covered. Applications to agronomic and environmental problems and instrument design and use are considered through discussion and problems sets.

CSS 663 Pedology
Spring. 3 credits. Prerequisite: CSS (SCAS) 361 or permission of instructor. M W F 12:20. Offered even spring semesters. R. B. Bryant.
Weathering, reactions, and processes of soil genesis. Principles of soil classification and the rationale and utilization of soil taxonomy. Development and significance of major groups of soils of the world.

CSS 666 Plant/Microbe Interactions
Fall. 3 or 4 credits. Prerequisite: CSS 366 or equivalent, or permission of instructor. Lecs, T R 10:10–11:25; lab, F 1:25–4:25. Offered alternate years. J. E. Thies.
Discussions on current research into plant/microbe interactions including: molecular signaling between plants and microbes involved in symbiotic, associative, or pathogenic interactions; and new methodologies for understanding the role(s) soil microorganisms play in plant production. Students participating in the optional lab section (for a total of four credits) undertake a group research project of current interest, the results of which will be presented in a final seminar.

CSS 667 Advanced Soil Physics
Spring. 3 credits. Prerequisites: one year of college physics and CSS (SCAS) 483 or permission of instructor. S-U grades optional. Hours TBA. Offered alternate years. P. C. Baveye.
A detailed study of measurement processes and of the hydrostatics of aqueous solutions in soils and porous media, with emphasis on fundamental principles. Examination of the molecular aspects of water-solid interactions, including shrink-swell phenomena and the properties of absorbed water. Analysis of equilibrium water adsorption from thermodynamical and mechanistic (molecular) standpoints. Also covered are mechanical and thermodynamical analysis of the equilibrium status of aqueous solutions in deformable soils. Formal lectures are complemented by tutorial sessions.

CSS 669 Organic Matter—Soils, Sediments, and Waters
Spring. 3 credits. Prerequisites: CSS (SCAS) 260 and CHEM 357–358 or equivalent. M W F 9:05. J. M. Duxbury.
A discussion of current concepts on the chemical nature, dynamics, and properties of natural organics and organo-mineral associations in terrestrial and aquatic environments. Interaction with anthropogenic organics and effects of anthropogenic activities on natural organics are considered.

CSS 671 Soil Chemistry
Fall. 3 credits. Prerequisite: 1 year of physical chemistry or permission of instructor. Offered alternate years. Lecs, M W F 10:10. M. B. McBride.
A detailed examination of the structure and surface chemistry of colloidal particles common to soils. Ion exchange, mineral-solution equilibria, and adsorption reactions of silicate clays, oxides, and organic matter are emphasized. The behavior of environmental contaminants in soils, particularly metals and toxic organics, is described.

CSS 693 Special Topics in Soil Science
Fall, spring, or summer. 1–6 credits. S-U grades optional.
Study of topics in soil science that are more specialized or different from other courses. Special topics to be covered will depend on staff and student interests.

CSS 880 Master's-Level Thesis Research in Soil Science
Fall or spring. Credit by arrangement. S-U grades only. Hours by arrangement. Graduate faculty.
Limited to students specifically in a master's program.

CSS 980 Graduate-Level Dissertation Research in Soil Science
Fall or spring. Credit by arrangement. S-U grades only. Hours by arrangement. Graduate faculty.
Limited to students in a Ph.D. program **only before** the "A" exam has been passed.

CSS 981 Doctoral-Level Dissertation Research in Soil Science
Fall or spring. Credit by arrangement. S-U grades only. Hours by arrangement. Graduate faculty.
Limited to students admitted to candidacy **after** the "A" exam has been passed.

EARTH AND ATMOSPHERIC SCIENCES

B. L. Isacks, chair; S. J. Riha, associate chair; D. S. Wilks (atmospheric science), R. W. Kay (geological sciences), K. H. Cook (science of earth systems), undergraduate advising coordinators; R. W. Allmendinger, W. Allmon, M. Barazangi, J. M. Bird, L. D. Brown, L. M. Cathles, J. L. Cisne, S. J. Colucci, A. T. DeGaetano, L. A. Derry, P. J. Gierasch, C. H. Greene, T. E. Jordan, S. Mahlburg Kay, M. C. Kelley, F. H. T. Rhodes, D. L. Turcotte, W. M. White, M. W. Wysocki

EAS 101 Introductory Geological Sciences
Fall, spring, or summer. 3 credits. Fall and spring, A. Moore; summer, W. Brice.
Designed to enhance an appreciation of the physical world. Natural environments, surface temperatures, dynamic processes such as mountain belts, volcanoes, earthquakes, glaciers, and river systems are emphasized. Interactions of the atmosphere, hydrosphere, biosphere, and lithosphere (Earth System Science) are covered. Water, mineral, and fuel resources and environmental concerns are also examined. Field trips in the Ithaca region.

EAS 102 Evolution of the Earth and Life (also BIO G 170)
Spring. 3 credits. J. L. Cisne.
This course covers: earth systems and their evolution; earth history's astronomical context; plate tectonics, continental drift, and their implications for climate and life; coevolution of life and the atmosphere; precedents for ongoing global change; and dinosaurs, mass extinctions, and human ancestry. Includes laboratories on reconstructing geological history and mapping ancient geography. Fossil collecting on field trips.

EAS 104 The Sea: An Introduction to Oceanography (also BIO EE 154)
Spring, summer. 3–4 credits (4 credits with lab section). Spring, C. H. Greene, W. M. White; summer, J. Chiment.
A survey of the physics, chemistry, geology, and biology of the oceans for both science and nonscience majors. Topics include: seafloor spreading and plate tectonics, marine sedimentation, chemistry of seawater, ocean currents and circulation, the oceans and climate change, ocean ecology, coastal processes, marine pollution, and marine resources.

[EAS 105 Writing on Rocks
Fall. 3 credits. Freshman Seminar. Not offered 2001–2002. J. Chiment.
See Freshman Seminar Handbook for description.]

EAS 106 Vertebrate Fossil Preparation
Spring. 1 credit. Prerequisites: 1 introductory geology course or concurrent enrollment, class size is limited. J. Chiment.
A laboratory-oriented course that exposes students to techniques of vertebrate fossil preparation. Roughing-out and fine preparation of large specimens in solid matrix are covered, as well as screen washing and microscope techniques for the recovery of micro-vertebrate remains. Specialized scanning techniques are discussed. The class meets for one hour each week for the first six weeks of the semester. Students are assigned to an individual or group project requiring two hours of participation each week for the remainder of the semester.

EAS 107 How the Earth Works
Fall. 1 credit. J. L. Cisne.
A user-friendly introduction to the workings and interactions of solid earth, ocean, atmosphere, and life as they relate to understanding ongoing global change.

EAS 109 Dinosaurs
Fall. 1 credit. J. L. Cisne.
An introductory survey course for anyone interested in dinosaurs. Lectures examine the fossil evidence and illustrate how various geological and biological disciplines contribute to understanding dinosaurs and their world.

EAS 111 To Know the Earth
Fall. 3 credits. J. M. Bird.
Acquaints the nonscientist with Earth, its major features, how the Earth has evolved, Earth System Science, and building a habitable planet. Covers the effects of human activity on geologic environments, mitigating environment damage, and living with natural hazards. Also covers mineral resource use in the twenty-first century and an environmentally sound fuel-minerals cycle.

EAS 122 Earthquake! (also ENGRI 122)
Spring. 3 credits. L. D. Brown.
The science of natural hazards and strategic resources is explored. Covers techniques for locating and characterizing earthquakes and assessing the damage they cause; methods of using sound waves to image the Earth's interior to search for strategic minerals; and the historical importance of such resources. Includes seismic experiments on campus to probe for groundwater, the new critical environmental resource.

EAS 131 Basic Principles of Meteorology
Fall. 3 credits. Lecs, T R 11:15; lab, T W or R 1:25–4:25 and M W 7:00–9:30 P.M. M. W. Wysocki.
A simplified treatment of the structure of the atmosphere: heat balance of the Earth; general and secondary circulations; air masses, fronts, and cyclones; and hurricanes, thunderstorms, tornadoes, and atmospheric condensation. In the laboratory, emphasis is on techniques of analysis of weather systems.

EAS 150 Introduction to Fortran Programming
Fall. 3 credits. Lec, T R 12:20–1:10; lab T 1:25–3:32. M. W. Wysocki.
An introduction to the elements of computer programming using Fortran. Exercises involve mainly meteorological problems.

EAS 200 Art, Archaeology, and Analysis (also ARKEO 285, ARTH 200, ENGRI 185, PHYS 200)
Spring. 3 credits. R. W. Kay.
An interdepartmental course on the use of techniques of science and engineering in cultural research. Applies physical and physiological principles to the study of archaeological artifacts and works of art. Covers historical and technical aspects of artistic creation. Includes analyses by modern methods to deduce geographic origins, and for exploration, dating, and authentication of cultural objects. Does not meet liberal studies distribution requirement for engineering.

EAS 201 Introduction to the Physics and Chemistry of the Earth (also ENGRD 201)
Fall. 3 credits. Prerequisites: PHYS 112 or 207. L. M. Cathles.

This course covers: formation of the solar system: accretion and evolution of the Earth; the rock cycle: radioactive isotopes and the geological time scale, plate tectonics, rock and minerals, earth dynamics, mantle plumes; the hydrologic cycle: runoff, floods and sedimentation, groundwater flow, and contaminant transport; and the weathering cycle: chemical cycles, CO_2 (weathering), rock cycle, controls on global temperature (CO_2 or ocean currents), and oil and mineral resources.

[EAS 203 Natural Hazards and the Science of Complexity

Fall. 3 credits. Prerequisites: 1 calculus course. Not offered 2001–2002. D. L. Turcotte.

Studies of natural hazards; earthquakes, volcanic eruptions, floods, hurricanes, tornadoes, severe storms, wildfires, and meteor impacts. Covers applications of the science of complexity to natural hazards: fractals, chaos, and self-organized criticality.]

EAS 210 Introduction to Field Methods in Geological Sciences

1 lec, Saturday field trips. 3 credits. Prerequisite: GEOL 101 (or 201) or permission of instructor. R. Allmendinger.

Considers the methods by which rocks are used as a geological database. Covers field methods used in the construction of geologic maps and cross sections; systematic description of stratigraphic sections. Field and laboratory sessions meet on Saturdays until Thanksgiving. There is also one additional lecture during most of these weeks. There is one weekend field trip to eastern New York.

EAS 212 Caribbean Field Trip

Spring. 2 credits. Prerequisite: permission of instructor. Enrollment limited to 15. Approximate cost $1,100. L. D. Brown.

A multidisciplinary look at earth science and environmental issues represented in the Yucatan Peninsula of Mexico. Base for operations is the Centro Ecologico Akumal, located on the Caribbean coast south of Cancun. This coast and its associated reef epitomizes the conflict between ecological preservation and economic development on an international scale. Excursions may include visits to Merida, a historic Spanish town which lies above the buried impact structure that many believe resulted in the death of the dinosaurs; ruins at Chichen Itza, Mayapan, Coba, and Tulum associated with the rise and fall of Mayan culture; and wildlife (monkeys, jaguars, crocodiles) preserves where recent geological studies have found evidence that the fall of the Mayans may have been triggered by climate change. The field trip features snorkel tours of reefs and lagoons as well as the cenotes (sinkholes) that characterize this classic karst landscape. Weekly lectures during the semester provide background; field trip scheduled for January.

EAS 213 Marine and Coastal Geology

Summer. 2 credits. Prerequisites: an introductory course in geology or permission of instructor. Staff.

A special one-week course offered at Cornell's Shoals Marine Laboratory (SML), on an island near Portsmouth, New Hampshire. For more details and an application, consult the SML office, G14 Stimson Hall. Estimated cost for 2002 (including tuition, room, board, and ferry transportation) is $1,100.

EAS 250 Meteorological Observations and Instruments

Spring. 3 credits. Prerequisite: EAS 131. Lecs, M W 12:20; lab, R 1:25–3:20. M. W. Wysocki.

This course covers methods and principles of meteorological measurements and observations including surface, free-air, and remote systems. Also covered are: instrument siting, mounting, and protection; instrument response characteristics, calibration, and standardization; and recorders and data logging systems. Laboratory exercises are in observation and data analysis. The course is intended to serve as preparation for Observers Examination. Lab fee $50.

EAS 260 Soil Science (also CSS 260)

Fall. 4 credits. S-U grades optional. Lecs, M W F 9:05; lab, M T W or R 1:25. S. J. Riha.

Designed for students interested in a comprehensive introduction to soil science from both an environmental and plant management perspective, this course is divided into three units. A unit on soil information introduces students to soil characterization, testing, mapping, classification, GIS, and land evaluation. A soil management unit addresses fertility, pest management, water, and microclimate, as well as erosion, conservation, pollution, and soil health. The unit on the role of soils in ecosystems considers topics such as biodiversity, soils as sinks and sources of greenhouse gases, and the impact of soils on land use. Labs are initially field-oriented with an emphasis on learning practical skills needed to evaluate and manage soils. Subsequent labs focus on accessing, interpreting, and applying soil information.

EAS 268 Climate and Global Warming

Spring. 3 credits. Prerequisite: basic college math. S-U grades optional. Lecs, M W F 9:05. A. T. DeGaetano.

Students from a range of disciplines become familiarized with such contemporary issues in climatology as global warming and El Niño. Introductions to the natural greenhouse effect, past climates, observed and projected climate changes and impacts. Also natural climate variations (e.g. El Niño) and their consequences and predictability. Weekly student-led discussions of issues appearing in journals such as *Nature*.

EAS 296 Forecast Competition

Fall and spring. 1 credit. S-U grades only. Prerequisites: sophomore undergraduate standing in atmospheric science, or permission of instructor. Time TBA. D. S. Wilks.

This two-semester course provides daily exercise in probabilistic weather forecasting, in which students compete to forecast local weather most skillfully. Enroll for two consecutive semesters, with credit awarded after the second semester. May be repeated for credit.

EAS 302 Evolution of the Earth System (also SES 302)

Spring. 4 credits. Prerequisites: MATH 112 or 192 and CHEM 207 or equivalent. Lecs and disc, TBA. W. White and staff.

Co-evolution of life and the Earth system: Earth's early history; plate tectonics, continental drift, and climate changes during the past billion years; mountain building, ice ages, and our own emergence during the past ten million years. Introduction to methods of interpreting information preserved in the rock record.

EAS 315 Geomorphology

Fall. 4 credits. Prerequisite: one course in either geology, hydrology, or soil science. T. E. Jordan and B. L. Isacks.

A study of the processes that sculpt the Earth's landscapes (above and below sea level) and the nature of those landforms. Landforms constructed by Earth's internal processes are the point of departure, as we examine their modification by physical interaction with the atmosphere and oceans. Also treated are depositional landforms that are generated by accumulations of grains or sediment. Laboratory exercises include both field examination of landforms of the Finger Lakes area and computer analysis of satellite images and Digital Elevation Models of examples from around the globe. Two Saturday field trips.

EAS 321 Introduction to Biogeochemistry (also SES 321, NTRES 321)

Fall. 4 credits. Prerequisites: CHEM 207, MATH 112, plus a course in biology and/or geology. L. A. Derry, J. Yavitt.

Control and function of the Earth's global biogeochemical cycles. The course begins with a review of the basic inorganic and organic chemistry of biologically significant elements, and then considers the biogeochemical cycling of carbon, nutrients, and metals that take place in soil, sediments, rivers, and the oceans. Topics include weathering, acid-base chemistry, biological redox processes, nutrient cycling, trace gas fluxes, bio-active metals, the use of isotopic tracers, and mathematical models. Interactions between global biogeochemical cycles and other components of the Earth system are discussed.

EAS 326 Structural Geology

Spring. 4 credits. Prerequisite: MATH 112, EAS 101 or 201, or permission of instructor. R. W. Allmendinger.

Nature and origin of deformed rocks at microscopic to macroscopic scales, with emphasis on structural geometry and kinematics. Topics include stress, strain, rheology, deformation mechanisms, minor structures, faulting, folding, and structural families.

EAS 331 Climate Dynamics (also ASTRO 331)

Fall. 4 credits. Prerequisites: MATH 112 or 192 or equivalent. Lecs, M W F 1:25–2:25; disc, W 2:30. K. H. Cook and P. J. Gierasch.

Processes that determine climate and contribute to its change are discussed, including atmospheric radiation, ocean circulation, and atmospheric dynamics. Contemporary climate change issues are investigated and discussed in the context of natural variability of the system.

EAS 334 Microclimatology

Spring. 3 credits. Prerequisite: A course in physics. T R 10:10–11:25. Offered alternate years. D. S. Wilks.

The relationships of radiant energy, temperature, wind, and moisture in the atmosphere near the ground. The interplay between physical processes of the atmosphere, plant canopies, and soil is examined with emphasis on the energy balance.

EAS 341 Atmospheric Thermodynamics and Hydrostatics
Fall. 3 credits. Prerequisites: 1 year of calculus and 1 semester of physics. M W F 9:05–9:55. M. W. Wysocki.
Introduction to the thermodynamics and hydrostatics of the atmosphere and to the methods of description and quantitative analysis used in meteorology. Topics covered include thermodynamic processes of dry air, water vapor and moist air, and concepts of hydrostatics and stability.

EAS 342 Atmospheric Dynamics
Spring. 3 credits. Prerequisites: 1 year each of calculus and physics. K. H. Cook and P. J. Gierasch.
Introduction to atmospheric dynamics and to the methods of description and quantitative analysis used in meteorology. Topics considered include equations of atmospheric motion, motion in the free atmosphere, vertical variations of wind and pressure fields, mathematical representation and characteristics of fronts, mechanisms of pressure change, concepts of circulation and vorticity, and effects of friction on atmospheric motion.

EAS 352 Synoptic Meteorology I
Spring. 3 credits. Prerequisites: EAS 341 and concurrent enrollment in EAS 342. Lecs, T R 9:05; lab, M 1:25–3:25. M. W. Wysocki.
Weather map analysis and forecasting techniques are studied by applying the principles of fluid and heat flow. This course strengthens previously introduced meteorological concepts which are applied to forecasting midlatitude synoptic scale weather systems, such as cyclones, anticyclones, jet streams, fronts, and waves.

EAS 355 Mineralogy
Fall. 4 credits. Prerequisite: EAS 101 or 201 and CHEM 207 or permission of instructor. S. Mahlburg Kay.
Examination of minerals by hand-specimen properties and optical microscopy. Geological setting, classification, crystal structures, phase relations, chemical properties, and physical properties of minerals are covered. X-ray diffraction is introduced. Includes an independent research project.

EAS 356 Petrology and Geochemistry
Spring. 4 credits. Prerequisite: EAS 355. R. W. Kay.
Principles of phase equilibrium as applied to igneous and metamorphic systems. Description, classification, chemistry, origin, regional distribution, and dating of igneous and metamorphic rocks. Geochemical distribution of trace elements and isotopes in igneous and metamorphic systems. Also covers the petrological evolution of the planets.

EAS 375 Sedimentology and Stratigraphy
Fall. 4 credits. Prerequisite: EAS 101 or 201. J. L. Cisne.
Covers formation of sedimentary rocks; depositional processes and environments; correlation of strata in relation to time and environment; petrology of sandstones and limestones; geological age determination; reconstruction of paleogeography and interpretation of Earth history from stratigraphic evidence; and organization of strata in stratigraphic sequences.

EAS 388 Geophysics and Geotectonics
Spring. 4 credits. Prerequisites: MATH 192 (or 112) and PHYS 208 or 213. B. L. Isacks.
Covers global tectonics and the deep structure of the solid earth as revealed by investigations of earthquakes, earthquake waves, the Earth's gravitational and magnetic fields, and heat flow.

EAS 411 Satellite Remote Sensing in Geosciences
Fall. 3 credits. Prerequisite: permission of instructor. B. L. Isacks.
Instruction in satellite remote sensing, image processing, geographic information systems (GIS), and analysis or digital elevation models using advanced computer workstations via participation in current research on earthquakes, glaciers, and tectonics.

EAS 417 Field Mapping in Argentina
Summer. 3 credits. Prerequisites: EAS 210 and 326; Spanish desirable, but not required. S. Mahlburg Kay.
Modern techniques of geological mapping applied in the region of San Juan, Argentina, including folded and faulted sedimentary rock units of the Andean Precordillera (San Juan River section), intensely deformed Precambrian metamorphic rocks of the Pampean Ranges (Pie de Palo), and shallow-level silicic intrusives (Cerro Blanco-Ullun).

[EAS 423 Petroleum Geology
Fall. 3 credits. Recommended: EAS 326. Offered alternate years. Not offered 2001–2002. Staff.
Introduction to hydrocarbon exploration and development. Covers exploration techniques, including well logs, fluid pressures, seismic-reflection methods, gravity, and magnetic measurements to map subsurface structures and stratigraphy. Also covers: petroleum origin and migration; dispersal systems and depositional patterns of petroleum reservoirs; economics of exploration, leasing, drilling, and production; and estimates of petroleum reserves, including tar sands and oil shales.]

EAS 434 Reflection Seismology
Spring. 4 credits. Prerequisites: MATH 192 and PHY 208, 213, or equivalent. L. D. Brown.
Fundamentals of subsurface imaging by multichannel seismic reflection techniques as used in oil exploration and geohydrological investigations. Covers survey design, acquisition, analysis, processing, and interpretation in both 2-D and 3-D. Includes discussion of related techniques such as seismic refraction analysis, tomographic inversion, vertical seismic profiling, shear wave exploration, and ground penetrating radar. Lab is keyed to state-of-the-art seismic processing, modeling, and interpretation software from LandMark.

EAS 435 Statistical Methods in Meteorology and Climatology
Fall. 3 credits. Prerequisites: 1 introductory course each in statistics (e.g., AEM (ARME) 210) and calculus. T R 10:10–11:25. D. S. Wilks.
Statistical methods used in climatology, operational weather forecasting, and selected meteorological research applications. Includes some statistical characteristics of meteorological data including probability distributions and correlation structures. Covers operational forecasts derived from multiple regression models including the MOS system. Also covers forecast verification techniques and scoring rules, time series analysis, EOFs, and other research topics as time permits.

EAS 437 Geophysical Field Methods
Fall. 3 credits. Prerequisites: PHYS 213 or 208, or permission of instructor. L. D. Brown.
Introduction to field methods of geophysical exploration, especially as applied to environmental issues. Emphasis is on seismic, ground penetrating radar, gravity, and magnetic techniques. Field surveys carried out at the beginning of the semester are analyzed and interpreted. A field companion to EAS 436, which is recommended but not required prior to this course.

[EAS 445 Geohydrology (also ABEN 471 and CEE 431)
Fall. 3 credits. Prerequisites: MATH 294 and ENGR 202. Not offered 2001–2002. W. Brutsaert, L. M. Cathles, J.-Y. Parlange, T. S. Steenhuis.
Intermediate-level study of aquifer geology, groundwater flow, and related design factors. Includes description and properties of natural aquifers, groundwater hydraulics, soil water, and solute transport.]

EAS 447 Physical Meteorology
Fall. 3 credits. Prerequisite: 1 year each of calculus and physics. M W F 10:10. Offered alternate years. A. T. DeGaetano.
Primarily a survey of natural phenomena of the atmosphere, with emphasis on their underlying physical principles. Topics include composition and structure of the atmosphere, atmospheric optics, acoustics and electricity, solar and terrestrial radiation, and principles of radar probing of the atmosphere.

EAS 451 Synoptic Meteorology II
Fall. 3 credits. Prerequisites: EAS 341 and 342. Lecs, T R 9:05; lab, M 1:25–3:20. S. J. Colucci.
Structure and dynamics of large-scale midlatitude weather systems, such as cyclones, anticyclones, and waves, with consideration of processes that contribute to temperature changes and precipitation. Laboratory sessions involve real-time weather forecasting and the computer application of a numerical model of the atmosphere to study selected large-scale midlatitude weather events.

[EAS 453 Advanced Petrology
Fall. 3 credits. Prerequisite: EAS 356. Offered alternate years. Not offered 2001–2002. R. W. Kay.
Magmas and metamorphism in the context of plate tectonics. Major and trace element chemistry and phase petrology as monitors of the creation and modification of igneous rocks. Temperature and stress in the crust and mantle and their influence on reaction rates and textures of metamorphic rocks. Application of experimental studies to natural systems.]

EAS 455 Geochemistry
Fall. 4 credits. Prerequisites: CHEM 207 and MATH 192 or equivalent. Recommended: EAS 356. Offered alternate years. W. M. White.
The Earth from a chemical perspective. Covers: the formation of the elements; cosmochemistry; chemical evidence regarding the formation of the Earth and solar system; trace-element geochemistry; isotope geochemistry; geochemical thermodynamics and kinetics; chemical evolution of the crust, mantle, and core; weathering and the chemistry of natural waters; chemistry of rivers and the oceans; hydrothermal systems; and ore deposition.

EAS 456 Mesoscale Meteorology
Spring. 3 credits. Prerequisites: EAS 341 and 342 or permission of instructor. T R 11:40–12:55. Offered alternate years. S. J. Colucci.
Structure and dynamics of midlatitude mesoscale weather systems such as fronts, jets, squall lines, convective complexes, precipitation bands, downslope windstorms, mountain breezes, sea breeze circulations, and lake effect snowstorms.

[EAS 457 Atmospheric Air Pollution
Fall. 3 credits. Prerequisites: EAS 341 or 1 course in thermodynamics, and 1 semester of chemistry, or permission of instructor. M W F 11:15–12:05. Offered alternate years. Not offered 2001–2002. M. W. Wysocki.
Course examines sources, effects, transport, measurement, and controls of air pollution. The basic principles in each area are discussed with an emphasis on their local, regional, and global impacts.]

[EAS 458 Volcanology
Spring. 3 credits. Corequisite: EAS 356 or equivalent. Offered alternate years. Not offered 2001–2002. R. W. Kay and W. M. White.
Causes of volcanism, melting in the Earth, and the origin of magmas. Physical volcanology, nature and types of volcanic eruptions and associated deposits, and eruption mechanisms. Volcanic plumbing systems, magma chamber processes, evolution of magma. Volcanism and impact phenomena in the solar system. Volcanic hazard assessment and volcano monitoring. Ore deposits associated with volcanism.]

[EAS 462 Marine Ecological Processes (also BIOEE 462)
Spring. 3 credits. Limited to 75 students. Prerequisite: BIOEE 261. Offered alternate years. Not offered 2001–2002. C. D. Harvell and C. H. Greene.
Lectures and discussion focus on current research in broad areas of marine ecology with an emphasis on processes unique to marine systems. A synthetic treatment of multiple levels of organization in marine systems including organismal, population, community, ecosystems, and evolutionary biology. Examples are drawn from all types of marine habitats, including polar seas, temperate coastal waters, and tropical coral reefs.]

EAS 475 Special Topics in Oceanography
Spring, summer. 2–5 var. credits. Prerequisites: EAS 104 or BIOEE 154, and permission of instructor. C. H. Greene.
Undergraduate instruction and participation in advanced areas of oceanographic research. Topics will change from term to term. Contact instructor for further information.

EAS 476 Sedimentary Basins: Tectonics and Mechanics
Fall. 3 credits. Prerequisite: EAS 375 or permission of instructor. T. E. Jordan.
Subsidence of sedimentary basins from the point of view of plate tectonics and geomechanics. Course covers interactions of subsidence, sediment supply, and environmental characteristics in development of stratigraphic sequences. Also covers stratigraphic characteristics of active-margin, passive-margin, and cratonic basins. Geophysical and stratigraphic modeling; sequence stratigraphy. Uses modern and ancient examples.

EAS 478 Advanced Stratigraphy
Fall. 3 credits. Prerequisite: EAS 375 or permission of instructor. Offered alternate years. T. E. Jordan.
Course covers modern improvements on traditional methods of study of ages and of genetic relations among sedimentary rocks, emphasizing 3-D relationships. Introduces techniques and applications of sequence stratigraphy at scales ranging from beds to entire basins. Physical correlation, dating techniques, and time resolution in sedimentary rocks are considered as are, physical controls on the stratigraphic record, and numerical modeling.

EAS 479 Paleobiology (also BIOEE 479)
Fall. 4 credits. Prerequisites: 1 year of introductory biology for majors and either BIOEE 274, 373, EAS 375, or permission of instructor. W. Allmon.
A survey of the major groups of organisms and their evolutionary histories. Intended to fill out the biological backgrounds of earth and atmospheric science students concerning the nature and significance of the fossil record for their respective studies.

EAS 481 Senior Survey of Earth Systems
Fall. 3 credits. Limited to seniors majoring in geological science. J. M. Bird.
A survey course that integrates undergraduate course work, intended to enhance overall understanding of geological sciences. Emphasis is on current models of Earth's dynamic systems (e.g., global climate change; mantle evolution). Utilizes guest lecturers; synthesis and review of literature; scientific literature readings; discussions; and student presentations.

[EAS 483 Environmental Biophysics (also CSS 483)
Spring. 3 credits. Offered alternate years. Prerequisites: EAS/CSS 260 or equivalent, or permission of instructor. M W F 11:15. Not offered 2001–2002. S. J. Riha.
Introduction to basic principles of energy and mass transfer and storage in soil-plant systems. Energy budgets, soil heat flow, water movement in saturated and unsaturated soils, evapotranspiration, water, gas, and nutrient dynamics in the soil-plant-atmosphere continuum are covered. Applications to agronomic and environmental problems and instrument design and use are considered through discussion and problem sets.]

EAS 491–492 Undergraduate Research
Fall, spring. 1 to 4 credits. Staff.
Introduction to the techniques and philosophy of research in the earth sciences and an opportunity for undergraduates to participate in current staff research projects. Topics chosen in consultation with, and guided by, a staff member. A short written report is required, and outstanding projects are prepared for publication.

EAS 494 Special Topics in Atmospheric Science (undergraduate level)
Fall or spring. 8 credits maximum. S-U grades optional. Staff.
The department teaches "trial" courses under this number. Offerings vary by semester, and are advertised by the department before the semester starts. The same course is not offered more than twice.

EAS 496 Internship experience
Fall or spring. 1–2 credits. S-U grades only. Staff.

EAS 497 Individual Study in Atmospheric Science
Fall or spring. 1–6 credits. S-U grades optional. Students must register with an Independent Study form. Staff.
Topics are arranged at the beginning of the term for individual study or for group discussions.

EAS 498 Teaching Experience in Atmospheric Science
Fall or spring. 1–5 credits. S-U grades optional. Students must register with an Independent Study form. Staff.
Teaching experience is obtained by assisting in the instruction of an atmospheric science course.

EAS 499 Undergraduate Research in Atmospheric Science
Fall or spring. Credit by arrangement. Students must register with an Independent Study form. Staff.
Independent research on current problems in atmospheric science.

EAS 500 Design Project in Geohydrology
Fall, spring. 3–12 credits. An alternative to an industrial project for M.Eng. students choosing the geohydrology option. May continue over 2 or more semesters. L. M. Cathles.
The project may address one of the many aspects of groundwater flow and contamination, and must involve a significant geological component and lead to concrete recommendations or conclusions of an engineering nature. Results are presented orally and in a professional report.

EAS 502 Case Histories in Groundwater Analysis
Spring. 4 credits. L. M. Cathles.
Groundwater flow in a specific area, such as a proposed nuclear-waste disposal site, analyzed in depth. Geological and resource data on the area are presented early in the course. Then the material is analyzed by students working as an engineering analysis team. Each student makes a weekly progress report and writes part of a final report. Results are presented in a half-day seminar at the end of term.

EAS 622 Advanced Structural Geology I
Spring. 3 credits. Prerequisites: EAS 326 and permission of instructor. Offered alternate years. R. W. Allmendinger.
Stress-strain theory and application. Advanced techniques of structural analysis. Topics include finite and incremental strain measurement; microstructure, preferred orientation, and TEM analysis; and pressure solution and cleavage development; and experimental deformation. Applications to deformation of unconsolidated sediments, brittle and brittle-ductile deformation of supracrustal strata, and ductile deformation of high-grade metamorphic rocks. Kinematic analysis of shear zones and folds in these regimes.

[EAS 624 Advanced Structural Geology II
Spring. 3 credits. Prerequisites: EAS 326 and permission of instructor. Offered alternate years. Not offered 2001–2002. R. W. Allmendinger.
Geometry, kinematics, and mechanics of structural provinces. Concentration is on thrust belts, rift provinces, or strike-slip provinces. Covers techniques of balanced cross sections.]

EAS 628 Geology of Orogenic Belts
Spring. 3 credits. Prerequisite: permission of instructor. J. M. Bird.
A seminar course in which students study specific geologic topics of an orogenic belt selected for study during the term. The course is intended to complement EAS 681.

[EAS 634 Advanced Geophysics I: Fractals and Chaos in Geology and Geophysics
Spring. 3 credits. Prerequisite: EAS 388 or permission of instructor. Offered alternate years. Not offered 2001–2002. D. L. Turcotte.
Course covers: definitions of fractal sets and statistical fractals, scale invariance, self-affine fractals, multifractals, applications to fragmentation, seismicity and tectonics, petroleum distribution and reserves, ore grade and tonnage, drainage networks and landforms, and floods and droughts. Definitions of chaos and self-organized criticality, renormalization groups, diffusion limited aggregation and percolation clusters, wavelet transforms, applications to mantle convection, the Earth's dynamo, and distributed seismicity.]

EAS 635 Advanced Statistical Meteorology
Fall. 3 credits. Prerequisites: coursework in or elementary knowledge of statistics, calculus, matrix algebra, and computer programming. Lec, T R 10:10–11:25, R 11:35–12:05. D. S. Wilks.
Lectures and topics concurrent with EAS 435, plus an extra 30-minute session per week in which selected topics from EAS 435 are treated in more depth, and additional topics are covered which may vary from year to year according to student interest. A term project is required. Not open to students who have taken EAS 435 for credit.

[EAS 636 Advanced Geophysics II: Quantitative Geodynamics
Spring. 3 credits. Prerequisite: EAS 388 or permission of instructor. Offered alternate years. Not offered 2001–2002. D. L. Turcotte.
Stress and strain in the Earth, elasticity and flexure, heat transfer, gravity, fluid mechanics, rock rheology, faulting, chemical geodynamics, flow in porous media.]

[EAS 641 Analysis of Biogeochemical Systems
Spring. 3 credits. Prerequisite: MATH 293 or permission of instructor. Offered alternate years. Next offered 2002–2003. L. A. Derry.
Covers: dynamics of biogeochemical systems. Kinetic treatment of biogeochemical cycles. Box models, residence time, response time. Analytical and numerical solutions of model systems. Eigen-analysis of linear systems. Feedback and nonlinear cases, problems of uncertainties in natural systems. Modeling software such as Stella II and Matlab; applications to current research of participants or from recent literature.]

[EAS 651 Advanced Atmospheric Thermodynamics (also ASTRO 651)
Fall. 3 credits. Prerequisites: a good background in undergraduate calculus and physics is required. Offered alternate years. Not offered 2001–2002. K. H. Cook, P. J. Gierasch, S. J. Colucci.
A survey of the fundamental physical processes in atmospheres. Topics include thermodynamics of atmospheric gases, moist effects, hydrostatics, convective instability, atmospheric radiation and radiative heating, radiative-convective equilibrium, clouds, cloud microphysics, and precipitation processes. Thermal structure and greenhouse effects on the Earth and other planets is discussed. The course is taught at the level of *Fundamentals of Atmospheric Physics* by Salby.]

[EAS 652 Advanced Atmospheric Dynamics (also ASTRO 652)
Spring. 3 credits. Prerequisites: EAS 341 and 342 or permission of instructor. T R 11:40–12:55. Offered alternate years. Not offered 2001–2002. S. J. Colucci, K. H. Cook, P. J. Gierasch.
Course covers quasigeostrophic theory, atmospheric waves, hydrodynamic instability, the general circulation of the atmosphere, and other topics selected from among numerical weather prediction and tropical, mesoscale, and middle atmosphere processes according to student interest.]

EAS 656 Isotope Geochemistry
Spring. 3 credits. Open to undergraduates. Prerequisite: EAS 455 or permission of instructor. Offered alternate years. W. M. White.
Nucleosynthetic processes and the isotopic abundance of the elements. Geochronology and cosmochronology using radioactive decay schemes, including U-Pb, Rb-Sr, Sm-Nd, K-Ar, U-series isotopes, and cosmogenic isotopes such as ^{14}C and ^{36}Cl. Use of radiogenic and stable isotopes in petrology and their application to study of the evolution of the crust and mantle. Isotopic evidence regarding the formation of the Earth and the solar system. Stable isotopes and their use in geothermometry, ore petrogenesis, paleontology, and the global climate system.

EAS 675 Modeling the Soil-Plant-Atmosphere System (also CSS 675)
Spring. 3 credits. Prerequisites: EAS/CSS 483 or equivalent. T R 8:40–9:55. Offered alternate years. S. J. Riha.
Introduction to the structure and use of soil-plant-atmosphere models. Topics covered include modeling plant physiology, morphology, and development; potential crop production and crop production limited by moisture and nutrient availability; plant-plant competition; and land surface processes as well as model data requirements, validation, and scale. Use of soil-plant-atmosphere models for teaching, research, extension, and policy formation is discussed.

EAS 681 Geotectonics
Fall. 3 credits. Prerequisite: permission of instructor. J. M. Bird.
Theories of orogeny; ocean and continent evolution. Kinematics of lithosphere plates. Rock-time assemblages of modern oceans and continental margins, and analogs in ancient orogenic belts. Time-space reconstructions of specific regions. Also covers problems of dynamic mechanisms—corollaries and evidence from crustal features.

EAS 692 Special Topics in Atmospheric Science
Fall or spring. 1–6 credits. S-U grades optional. Staff.
Study of topics in atmospheric science that are more specialized or different from other courses. Special topics to be covered depend on staff and student interests.

EAS 695 Computer Methods in Geological Sciences
Fall, spring. 3 credits. L. Brown and B. L. Isacks.
Independent research projects using modern computational resources in the Department of Earth and Atmospheric Sciences. Possibilities include: image and seismic processing, seismic and geomechanical modeling, GIS, use of interpretational workshops for 3-D seismics and satellite imagery; modeling fluid flow through complex media.

EAS 700–799 Seminars and Special Work
Fall, spring. 1–3 credits. Prerequisite: permission of instructor. Staff.
Advanced work on original investigations in earth and atmospheric sciences. Topics change from term to term. Contact appropriate professor for more information.

EAS 722 Advanced Topics in Structural Geology
R. W. Allmendinger.

EAS 731 Plate Tectonics and Geology
J. M. Bird.

[EAS 733 Fractals and Chaos—Independent Studies
Not offered 2001–2002. D. L. Turcotte.]

EAS 751 Petrology and Geochemistry
S. Mahlburg Kay and R. W. Kay.

[EAS 753 Advanced Topics in Mineral Physics
Not offered 2001–2002.]

EAS 755 Advanced Topics in Petrology and Tectonics
J. M. Bird.

EAS 757 Current Research in Petrology
S. Mahlburg Kay and R. W. Kay.

[EAS 762 Advanced Topics in Petroleum Exploration
Not offered 2001–2002.]

EAS 771 Advanced Topics in Sedimentology and Stratigraphy
T. E. Jordan.

EAS 773 Paleobiology
J. L. Cisne.

EAS 775 Advanced Topics in Oceanography
Spring. C. H. Greene.

EAS 780 Earthquake Record Reading
Fall, M. Barazangi.

EAS 781 Geophysics, Exploration Seismology
L. D. Brown.

EAS 783 Advanced Topics in Geophysics
B. L. Isacks.

EAS 789 Lithospheric Seismology (COCORP Seminar)
L. D. Brown.

EAS 793 Andes-Himalaya Seminar
S. Mahlburg Kay, R. W. Allmendinger, B. L. Isacks, and T. E. Jordan.

EAS 795 Low Temperature Geochemistry
L. A. Derry.

EAS 796 Geochemistry of the Solid Earth
W. M. White.

EAS 797 Fluid-Rock Interactions
L. M. Cathles.

EAS 799 Soil, Water, and Geology Seminar
L. M. Cathles and T. S. Steenhuis.

EAS 850 Master's-Level Thesis Research in Atmospheric Science
Fall or spring. Credit by arrangement. S–U grades only. Hours by arrangement. Graduate faculty.
Limited to students specifically in the master's program in atmospheric science.

EAS 950 Graduate-Level Dissertation Research in Atmospheric Science
Fall or spring. Credit by arrangement. S-U grades optional. Hours by arrangement. Graduate faculty.
Limited to students in the atmospheric science Ph.D. program only **before** the "A" exam has been passed.

EAS 951 Doctoral-Level Dissertation Research in Atmospheric Science
Fall or spring. Credit by arrangement. S-U grades optional. Hours by arrangement. Graduate faculty.
Limited to students admitted to candidacy in the atmospheric science Ph.D. program **after** the "A" exam has been passed.

EDUCATION

D. E. Hedlund, chair; G. J. Applebee, N. T. Assie-Lumumba, C. A. Conroy, J. A. Dunn, D. M. Ewert, M. M. Kroma, S. K. Kroma, J. J. Lo, S. J. Peters, S. C. Piliero, G. J. Posner, R. E. Ripple, V. N. Rockcastle, D. E. Schrader, J. W. Sipple, H. D. Sutphin, D. J. Trumbull, D. G. Way, A. L. Wilson

EDUC 005 Basic Review Mathematics
Fall and spring. 3 credits (this credit is not counted toward the 120 credits required for the degree). Lecs, M W F 8:00 or 9:05. J. J. Lo.
Review of concepts necessary for success in basic mathematics and statistics courses. Topics include problem solving, graphing, basic algebra skills, linear and quadratic functions, polynomial equations, exponents and logarithms, and trigonometry. Considerable emphasis is placed on learning mathematics for understanding and solving word problems.

EDUC 100 Multiculturalism in Education
Fall. 3 credits. M W F 10:10–11:25. S. Kroma.
Should schools provide mandatory bilingual education programs to non-English speaking students? Should the United States adopt an "English Only" official language policy? Should Kwanza be celebrated as a public holiday? These are some of the many questions that challenge the notion of "cultural unity" one expressed as the "melting pot." In this course students develop writing skills as they explore discourse on the forces responsible for our cultural diversity and the changing perspectives on our "cultural unity." Through writing activities, students learn to critically examine the historical, political, and legal contexts of this diversity and define their own views on the competing public positions that multicultural education issues arouse.

[EDUC 101 Introduction to Education
Fall. 3 credits. T R 11:40–12:55. Not offered 2001–2002. Staff.
An introduction to the field of education that is structured around an examination of three contemporary policy issues. The issues are chosen to help students understand important aspects of formal schooling systems (e.g., the public schools, colleges, and universities) as well as nonformal educational activities (e.g., adult education, extension education, and community education). The course is team-taught by two members of the faculty and is designed for students seeking a self-contained introduction to education that can also lead to additional study in the field.]

EDUC 115 Introductory College Mathematics
Fall and spring. 4 credits. M W F 11:15 or 12:20. J. J. Lo.
Designed for students wishing to fulfill distribution requirements and/or prepare for study in calculus. This course offers a multi-representational approach to college-level precalculus mathematics, stressing conceptual understanding, problem solving, and applications in a technology-enhanced environment. Considerable emphasis is placed on numerical, graphical, and symbolic representations of functions and their transformations. Students use graphing calculators in a collaborative lab setting.

[EDUC 120 Education for Empowerment
Spring. 3 credits. W 1:25–4:25. Not offered 2001–2002. Staff.
Common themes running through the modules include human learning, teaching strategies, and political/social/economic factors affecting education. The course provides an opportunity to sample different areas of study and to gain knowledge and awareness of one's own educational processes.]

[EDUC 210 Psychology of Learning and Memory
Fall. 3 credits. Prerequisite: introductory psychology. W 2:00–4:25; plus time TBA. Not offered 2001–2002. J. A. Dunn.
This course deals with contemporary theories of learning, issues in the study of learning, and application of the principles of learning to the management of teaching and learning. Practical applications of research findings are emphasized. One or more experimental projects and the use of microcomputers is required.]

[EDUC 212 Psychological Foundations of Education
Spring and fall. 3 credits. Limited to 20 students. S-U option available. Prerequisite: introductory psychology. W 2–4:25 plus times TBA. Not offered 2001–2002. J. A. Dunn.
A lecture/discussion survey of the psychological foundations of educational practice. Topics include the selective contributions of developmental, social, and experimental psychology, including instructional technology, to American education.]

EDUC 220 Community Learning and Service Partnership
Fall and spring. 4 credits. Limited to 25 students. S-U grades optional. T R 2:55–4:10. A. Wilson.
Students learn to be self-directed learners and to be critical observers of their own experiential learning; class focuses on issues of diversity and empowerment, interpersonal communication, and critical analysis. Students practice adult education facilitation techniques through participation in a campus-based adult education program, the Community Learning and Service Partnership (CLASP).

EDUC 240 The Art of Teaching
Fall and spring. 3 credits. Fall: M 12:20–2:15 or T 2:30–4:25, W 12:20–2:15 or 2:30–4:25. Spring: M 8–9:55 or 12:20–2:15 or T 2:30–4:25 or W 12:20–2:15 or 2:30–4:25. Fall, staff; spring, G. J. Posner and staff.
This course is designed for all students interested in finding out more about teaching. Students engage in field experiences to find out what teaching involves. Possible field experiences range from large group to tutorial situations, from preschool to adult education, from traditional school subject matters to recreational and vocational areas, and from school-based to nonformal situations. Class work builds on those experiences and provides skills and concepts to make the field experiences more profitable.

EDUC 271 Sociology of Education
Fall. 3 credits. S-U grades optional. T R 10:10–11:25. J. W. Sipple.
An introduction to the sociological study of schooling and education. Topics include the effects of social factors on educational achievement, the norms and values learned as part of the process of schooling, the relations between students and teachers, and the school's relations to the economic and political systems. All levels of education, from elementary school to the university, are considered.

EDUC 311 Educational Psychology
Fall. 3 credits. Prerequisite: introductory psychology. S-U grades optional. M W F 11:15–12:05. D. E. Schrader.
This course applies psychological concepts to educational settings with a focus on understanding the interaction between people, context, and knowledge in schools and other learning environments. It examines education as a social, moral, and interpersonal enterprise that respects differences between individuals. This course is designed to foster effective teaching and learning across the life span, but has a focus on secondary education.

EDUC 317 Psychology of Adolescence
Spring. 3 credits. Prerequisite: introductory psychology. S-U grades optional. M W 11:15–12:05; Friday morning section TBA. D. E. Schrader.
This course surveys the nature of adolescent cognitive, social, moral, and self-development. Theories of adolescence are examined in the context of real-life experiences of adolescents using case analysis as a methodological tool. Educational implications are discussed for both formal and informal settings.

EDUC 331 Careers in Agriculture, Extension, and Adult Education
Fall. 1–3 credits. Letter grade only. F 2:00–4:25. D. E. Foster, and G. J. Applebee.
This course offers modules in three areas of teaching: Adult Education, Cooperative Extension, and Agricultural Education. Each module offers one hour of credit, and students may take one or more of the modules. The course provides an historical perspective and an introduction to the organization and scope of programs for each module. Students examine career opportunities and characteristics of the professions addressed by each module. Course activities include field observations and experiences during arranged times.

EDUC 332 Instructional Methods in AgriScience Education
Spring. 1–3 credits. Prerequisite: enrollment in a Cornell teacher education program or permission of instructor. R 2:00–4:25. C. A. Conroy.
Selection, practice, and evaluation of methods in AgriScience education are stressed. The course offers a modular approach to focus on teaching strategies and methodology unique to teaching in schools. Content includes program planning (Module I), experiential learning (Module II), and youth leadership (Module III). All students must enroll for one credit in Module I; students may be exempt from Modules II and III with permission of instructor. Participants are required to participate in field experiences at arranged times.

[EDUC 335 Youth Organizations
Spring. 3 credits. T R 10:10–11:25; lab TBA. Not offered spring 2002. Staff.
Visionary, creative, and competent leaders are essential for youth organizations. Class participants learn how to facilitate both youth and adult volunteer leadership development. They examine factors affecting membership, purposes, design, operation, and administration of youth organizations. The course provides students with indepth learning-by-doing experience of how youth organizations function. Field experience with a recognized youth organization is required.]

EDUC 370 Issues in Educational Policy
Spring. 3 credits. T R 10:10–11:25. Staff.
An examination of selected policy issues in current education. Included are such topics as equality of educational opportunity; student, parent, and teacher rights; and educational politics. Issues are treated from legal, sociological, and economic perspectives. Meets group C requirements for College of Agriculture and Life Sciences.

EDUC 378 Political Economy of Education
Fall. 3 credits. S-U grades optional. T R 1:25–2:40. Staff.
A policy oriented examination of educational systems with an emphasis on political and economic perspectives. Attention is paid to both external and internal aspects of educational activities. Specific topics include the changing contributions of education to earnings, school-community relations, power within educational organizations, the impact of technology in the workplace and in classrooms, and the sources and impact of educational costs. A variety of education settings are examined including higher education and non-formal education.

EDUC 380 Independent Honors Research in Social Science
Fall or spring. 1–6 credits. Limited to students who have met requirements for the honors program. S-U grades optional. A maximum of 6 credits may be earned in the honors program. Staff.

EDUC 401 Our Physical Environment
Fall. 3 credits. Prerequisite: permission of instructor. Charge for laboratory supplies, approximately $7. T 1:25–4:25. V. N. Rockcastle.
A practical, relatively nonmathematical study of some basic relationships and physical interactions in the environment, with emphasis on physics and earth science. Attention is paid to analysis for understanding and techniques for teaching. An individual research project is included. Useful for teachers, environmental educators, and those for whom physical science seems difficult or uninviting.

EDUC 402 Knowing and Learning in Science, Mathematics, and Agriscience
Fall. 4 credits. Prerequisite: enrollment in a Cornell teacher education program or permission of instructor. M W 2:30–4:20. D. J. Trumbull.
Students examine both current notions in the history and philosophy of science that explain how knowledge within a discipline develops and current theory and research that examines the individual's acquisition of knowledge. This material serves as a basis for students' individual research projects investigating neophytes' knowledge of science and mathematics concepts. All students enrolled must complete fieldwork. Fieldwork comprises a minimum of three hours a week in an appropriate educational setting.

EDUC 403 Observing and Teaching Science, Mathematics, and Agriscience
Spring. 4 credits. Prerequisites: EDUC 402, enrollment in a Cornell teacher education program or permission of the instructor. C. A. Conroy.
Designed for prospective secondary teachers, this course provides a multiple-perspectives orientation to the culture of schools and the work of teaching science and mathematics. Students spend six to eight hours each week observing in area schools. Students also plan and teach innovative lessons in the scheduled teaching laboratory. Includes readings and discussions planning, delivery, and evaluation of instruction classroom management, and other issues such as equity, tracking, and classroom language.

[EDUC 413 Psychology of Human Interaction
Fall. 3 credits. Enrollment limited. Prerequisite: permission of instructor. T R 10:10–12:05. Not offered 2001–2002. D. E. Hedlund.
Designed to develop skills for, and understanding of, effective interpersonal communication and interaction. Appropriate for students in the helping professions, education, and areas involving management of human resources.]

[EDUC 414 Counseling Psychology
Spring. 4 credits. Prerequisites: introductory psychology, social or personality psychology. T R 10:10–12:05. Not offered 2001–2002. D. E. Hedlund and staff.
The processes of counseling are examined from various theoretical perspectives. Typical counseling issues are examined, and implications are drawn for counseling strategies, including psychological assessment, establishing therapeutic goals, intervention strategies, and evaluation of outcomes.]

EDUC 420 Field Experience
Fall or spring. 1–4 credits. S-U grades optional. Undergraduates must attach to their course enrollment material written permission from the faculty member who will supervise the work and assign the grade. Staff.
Students may engage in planned, semiprofessional, or professional practice in an educational enterprise. Each student prepares a plan of action including rationale, purposes, and procedures and arranges with a faculty member to supervise and evaluate their field experience.

EDUC 441 Language Acquisition, Literacy, and Schooling
Spring. 4 credits. Prerequisites: education majors or permission of instructor. M W 8:40–9:55; lab, TBA. S. Kroma.
This course examines current research, policy, and practice relating to the acquisition of first and second languages, the dynamics of literacy in school contexts, and the development of academic language proficiency. Emphasis is placed on understanding the processes by which the language arts (listening, speaking, reading, and writing) progress in first and second languages, and the roles they play in academic development. Students spend two out-of-class hours a week working with learners in language acquisition or literacy development settings and undertake practical projects involving analyses of second language performance, writing, or oral reading behavior.

EDUC 445 Curriculum Design Workshop
Summer. 3 credits. G. J. Posner.
A general practical approach to course planning. Readings, group discussions, workshops, and individual conferences centering on each student's project. This project consists of designing a course in a subject area for an age level and an institutional setting of the student's choosing.

EDUC 447 Curriculum Design Laboratory: A Technology-Intensive Course
Spring or summer. 3 credits. Staff.
A project-focused introduction to course design, from needs assessment, through materials development, to the evaluation of student outcomes. The course involves the creation and implementation of an actual curriculum, and the nature of the project varies from year to year. Students are expected to make extensive use of computer software writing, design, management, and communications. The summer section of 447 is smaller and rather than working on a single class project, students undertake curriculum development projects of their own design.

EDUC 459 Education in Africa and the Diaspora (also AS&RC 459)
Fall. 3 credits (4 in CA&S). T 10:10–12:35. N. Assié-Lumumba.
This course deals with educational innovations geared to promoting equal opportunity based on gender, race, and class in Africa and the African Diaspora. After an introduction on the concepts and innovations and the stages of innovation as planned change, the course focuses on concrete cases and different types of educational innovations. The selected case studies, in the United States, include the creation and expansion of historically black institutions with a focus on Tuskegee Institute (now Tuskegee University), Lincoln University, Spelman College, and the Westside Preparatory School in Chicago. The African cases to be studied include African languages for instructing in Nigeria and science educational in Nigeria, Ujamaa and education for self-reliance in Tanzania, television as a medium of instruction and technological innovation in Côte d'Ivoire, classroom action research in Lesotho, and higher education and distance learning in South Africa.

EDUC 463 Policy Issues in Distance Learning in Developing Countries
Spring. 3 credits. S-U grades optional. T 2:00–4:25. N. Assié-Lumumba.
Distance Learning is being increasingly adopted to respond to the high demand for education in developing countries. This course critically analyzes distance education for the general population as well as specific social and professional categories. A typology of the ICTs (Information and Communication Technologies) used and the different forms of virtual learning institutions are examined.

EDUC 472 Philosophy of Education
Fall. 3 credits. T 2:30–4:25. Staff.
A study of central issues in the philosophy of education. Questions of ethics, political philosophy, and the theory of knowledge are examined and linked to current educational issues.

EDUC 477 Law and Educational Policy
Fall. 3 credits. M 2:30–4:25. Staff.
A study of recent federal court decisions concerning education. Emphasis is on examining legal issues against a background of related educational issues and in terms of the consequences of legal decisions for the development and operation of educational institutions.

EDUC 480 Global Seminar: Environment and Sustainable Food Systems (also ALS 480 and INTAG 480)
Spring. 1–3 credits. Prerequisite: juniors, seniors, and graduate students. Letter grade. Lec, R 8:00–9:55 a.m., Lab, 3:35–4:25 p.m. scheduled, one additional hour unscheduled. H. D. Sutphin, P. A. Arneson, and D. Lee.
For description, see ALS 480.

EDUC 483 Comparative Studies in Adult Education
Spring. 3 credits. S-U grades optional. T R 3:35–5:00. M. Kroma.
Focuses on the variety of adult-education programs in countries around the world. Literature on comparative adult education, international conferences on adult education, UNESCO adult-education publications, and international community development are analyzed in relationship to each student's exploration of adult education in two countries. Description of adult education in other countries is shared by international students.

EDUC 494 Special Topics in Education
Fall or spring. 4 credits maximum. S-U grades optional. Hours TBA. Staff.
The department teaches "trial" courses under this number. Offerings vary by semester, and will be advertised by the department before the semester starts. Courses offered under this number will be approved by the department curriculum committee, and the same course is not offered more than twice under this number.

EDUC 495 Senior Seminar
Spring. 2 credits. Education majors or permission of instructors. S-U only. TBA. Undergraduate coordinator for the department.
This seminar focuses in depth on two or three significant educational issues, which may vary from year-to-year depending on the interests and background of students and faculty. The seminar attempts to help students relate the knowledge gained in their particular concentrations to a set of broad issues in education. While education faculty is involved in selecting the issues and providing guidance for the seminar, students are expected to provide the initiative and leadership in the classroom.

EDUC 497 Individual Study in Education
Fall or spring. 1–3 credits. S-U grades optional. Students must register with an Independent Study form (available in 140 Roberts Hall). Hours TBA. Staff.
A student may, with approval of a faculty adviser, study a problem or topic not covered in a regular course or may undertake tutorial study of an independent nature in an area of educational interest.

EDUC 498 Undergraduate Teaching
Fall or spring. 1 or 2 credits; 4 credits maximum during undergraduate career. Limited to students with GPA of at least 2.7. S-U grades optional. Students must register with an Independent Study form (available in 140 Roberts Hall). Hours TBA. Staff.
Participating students assist in teaching a course allied with their education and experience. Students are expected to meet regularly with a discussion or laboratory section, to gain teaching experience, and regularly to discuss teaching objectives, techniques, and subject matter with the professor in charge.

EDUC 499 Undergraduate Research
Fall or spring. 6 credits maximum during undergraduate career. Not open to students who have earned 6 or more undergraduate research credits elsewhere in the college. Limited to juniors and seniors with GPAs of at least 2.7. Students must register with an Independent Study form (available in 140 Roberts Hall). Hours TBA. Staff.
Affords opportunities for students to carry out independent research under appropriate supervision. Each student is expected to review pertinent literature, prepare a project outline, conduct the research, and prepare a report.

EDUC 502 Education and Development in Africa (also AS&RC 502)
Spring. 3 credits (4 in CA&S). S-U grades optional. T 2:00–4:25. N. Assié-Lumumba.
In the 1950s and 1960s, human capital theory that emphasizes the importance of formal education for achievement of full productive potential of individuals and economic growth and development of countries enjoyed a renewed popularity. African countries promoted education expansion with the expectation that it would lead to socio-economic development. The initial euphoria, however, was followed by skepticism and then disillusion. Education, as it was being organized, delivered, received, and utilized began to be perceived even as a hindrance to development. This course examines the relationship between formal education and individual and national development. Different paradigms of development, including modernization and dependency theories, and Third World Forum are examined. Issues discussed include education and schooling, the role of primary, secondary, and higher education in development, the problems of employment, language, equity in access, and results based on social class, ethnicity, race, and gender. Endogenous knowledge, new perspectives for relevant education, and the role of international organization and cooperation are also discussed.

EDUC 507 Environmental Inquiry (also NTRES 507)
Summer. 1–3 credits. S-U grades optional. Prerequisite: limited to preservice or inservice secondary science teachers. Permission of the instructor required. M. E. Krasny.
Exploration of selected topics in environmental science and environmental science education at the secondary school level. The subject-matter focus varies from year to year, and tracks ongoing research and development conducted through Cornell's Environmental Inquiry project, a collaboration between the Departments of Education and Natural Resources and the Center for the Environment. Current work centers on watershed dynamics, biodegradation, environmental toxicology, and invasive species.

EDUC 513 Interpersonal Interaction
Summer. 1–2 credits. D. E. Hedlund.
Designed to develop skills for an understanding of effective interpersonal communication and interaction. Appropriate for students in the helping professions, education, and areas involving management of human resources. A workshop design is required for the second credit. Participants must bring a tape recorder to class.

EDUC 523 Food and Fiber Across the Curriculum
Summer. 0–3 credits. J. Hawkes.
An intensive five-day course designed to help New York State elementary teachers and administrators implement the New York Agriculture in the Classroom Program and understand the complexity of New York's leading industry. Participants learn how instructional materials and experiences with our food-fiber system can be used to teach students language arts, mathematics, science, and social studies. One credit is earned by class attendance and participation. Two credits require one additional project. Three credits require two additional projects.

EDUC 548 Effective College Teaching
Spring. 1–3 credits. S-U grade option. T 5:00–7:00. D. Way.
This course is designed to help participants become more effective college teachers. It examines the basic principle of learning, identifies different learning styles, and explores a variety of teaching techniques, methods, and technologies. Participants also learn how to design a course and improve their effectiveness as teachers.

EDUC 578 International TA Training Course: Cross-Cultural Classroom Dynamics, Pronunciation and Language, Video Teaching Practicum
Fall and spring. 2 credits. S-U only. TBA. I. Arnesen, E. Burns, G. Wolek, D. Mendelson.
Designed for first-time international teaching assistants from countries in which English is not the primary language, the ITATP course focuses on three areas: cross-cultural classroom dynamics, video-teaching practicum, and language—enhancing communicative competence in English. Through small group seminars and individual conferences, the ITATP helps international TAs develop their linguistic and pedagogical skills as they gain sensitivity to the dynamics of U.S. classrooms.

EDUC 601 Secondary Agriculture, Science, and Mathematics Teaching Practicum

Fall or spring. 6 credits. Prerequisite: permission of instructor. Letter grades only. For graduate students enrolled in the Teacher Education in Science and Mathematics Program. M T W R F 8:00–3:00. C. A. Conroy, S. C. Piliero, G. J. Posner, A. Solomon, and D. J. Trumbull.

Supervised student teaching in science or mathematics at the secondary level. Program includes teaching in a local school for ten weeks.

EDUC 602 Teaching Agriculture, Science/Mathematics: Methods, Materials, Practice

Fall or spring. 9 credits. Prerequisite: concurrent enrollment in EDUC 601 or permission of instructor. M T W R F 9:00–3:00. Staff.

The course begins with full day sessions of intensive consideration of theoretical frameworks relevant to all aspects of student teaching. Assignments and a weekly seminar during the semester require students to use those theories to develop and evaluate teaching materials and practices. Students complete an extensive portfolio documenting their work.

[EDUC 606 Seminar in Science and Mathematics Education

Fall. 1 credit. S-U grades only. T 4:30–5:30. Not offered 2001–2002. Staff.

Explores topics in science and mathematics education. The focus of the seminar changes each year.]

EDUC 609 Methods for Interpretive Research

Spring. 3 credits. Prerequisite: course in research methods or measurement or permission of instructor. T R 2:55–4:10. D. J. Trumbull.

This course examines some of the methods of educational interpretive research. An interpretive research perspective attends to the complex interactions between researcher, researched, and contexts and accepts the centrality of interpretation in the conduct of human affairs. This perspective imposes some unique demands on researchers wishing to justify the quality of their projects. In the class, students practice methods for gathering and interpreting data by conducting a small project using methods as they relate to the aims and assumptions of interpretive research.

EDUC 611 Educational Psychology

Fall. 3 credits. Prerequisite: introductory psychology. S-U grades optional. M W 11:15–12:05. R. E. Ripple.

A basic survey course for graduate students (selected undergraduates admitted with permission). Emphasis is on psychological factors involved in human learning and the educational process. Set in a broad-based conceptual model of any behavioral setting for learning. A life span developmental approach is used, appropriate for those seeking an introduction to educational psychology or a refresher course in contemporary educational psychology.

EDUC 614 Gender, Context and Epistemological Development (also WOMNS 624)

Fall. 3 credits. S-U grades optional. M 12:20–2:15. D. E. Schrader.

Insight into how individuals make sense of knowledge is essential to teaching and learning. This course examines theories of intellectual development and their implications for educating students of various age groups, particularly college students. The role of reflection on thinking (metacognition) and its impact on development of thought is explored.

EDUC 615 Self and Interpersonal Development and Education (also WOMNS 625)

Spring. 3 credits. S-U grades optional. M 12:20–2:15. Offered alternate years. D. E. Schrader.

Interpersonal interactions affect teaching and learning. This course takes a life-span perspective as it explores constructive-developmental theories of self and others, the influence of gender, and how such theories explain students' understanding of their own and others' actions in educational contexts.

EDUC 620 Internship In Education

Fall or spring. 1–6 credits. S-U grades optional. Each student, before course enrollment, must obtain the approval of a faculty member who will assume responsibility for supervising the work. Staff.

An opportunity for practical experience in educational professions development.

[EDUC 621 Work-Experience Coordinator Certification Course I

Summer. 3 credits. S-U grades optional. Not offered 2001–2002. D. E. Foster.

The first of a two-course sequence designed to develop the competencies needed for certification as a coordinator of diversified cooperative work experience programs. The course focuses on the history and philosophy, types, operation, and evaluation of work-experience programs including articulation with JPTA and VESID. Field interviews are required. A prerequisite for Course II, EDUC 622.]

[EDUC 622 Work-Experience Coordinator Certification Course II

Summer. 3 credits. Prerequisite: EDUC 621 Work-Experience Certification Course I. Not offered 2001–2002. D. E. Foster.

The second course for certification as a diversified cooperative work experience coordinator combines course work and directed field experience leading to the planning, development, and approval of a work-experience program in a local educational agency. Development of a philosophy and policy statement, budget, curriculum for related instruction, annual work plan by function, promotional materials, and all program forms for Board of Education approval required.]

EDUC 630 Special Problems in Agricultural, Extension, and Adult Education

Fall or spring; may also be offered in summer. 1–3 credits. S-U grades optional. Hours TBA. Staff.

The course provides an opportunity for graduate-level study of individually selected problems and issues in agricultural, extension, and adult education.

EDUC 632 Teaching Agricultural, Extension, and Adult Education

Summer. 3 credits. Prerequisite: an introductory course in teaching methods or permission of instructor. Hours TBA. C. A. Conroy.

The focus of the course is on the selection, use, and evaluation of methods and materials for teaching. Methods for group and informal instruction are covered. Opportunity is provided for students to develop teaching competence based on their individual needs and interests. Development of self-evaluation skills is included. A class project on the development of instructional materials is required.

EDUC 633 Program Planning in Agricultural, Extension, and Adult Education

Spring. 3 credits. S-U grades optional. Lec, R 2:00–5:00. A. Wilson.

Current social and economic conditions affecting agricultural, extension, and adult education are examined. Principles, objectives, strategies, and sources of information are applied to program planning. Participants have an opportunity to observe ongoing programs in agricultural, extension, and adult education and to pursue individual interests in program development and improvement.

[EDUC 635 Experiential Learning

Fall. 2 credits. Prerequisite: open to undergraduates with permission of instructor. S-U grades optional. T 12:20–2:15. Not offered 2001–2002. Staff.

Participants explore various dimensions of scholar and practitioner thinking about the understanding and practice of experiential learning. Theoretical perspectives on experiential education, reflective practice, and a critical learning systems perspective are explored through readings and applied assignments. The instructor introduces methods of facilitation designed to encourage inquiry and dialogue for improvement of both nonformal and formal educational activities. The course process is intended to engage participants in reflective dialogue—nurturing emergence of learning community elements.]

[EDUC 644 Curriculum Theory and Analysis

Spring. 3 credits. M 1:25–4:25. Not offered 2001–2002. G. J. Posner.

An examination of the basic elements involved in making curriculum decisions and an analysis of current approaches to curriculum. The course focuses on the assumptions underlying any curriculum. The major task of each student is to choose and conduct an in-depth analysis of a curriculum. This course is the basic graduate course in curriculum.]

EDUC 661 Administration of Educational Organizations

Fall. 3 credits. R 3:35–6:00. J. W. Sipple.

Perspectives on the administration of educational organizations. Consideration of social science, legal and ethical theories, and their application to both public schools and higher education. Intended for students who are considering careers as educational administrators, as well as for those who want to further their understanding of educational organizations.

[EDUC 664 Educational Finance
Fall. 3 credits. S-U grades optional. W 3:35–6:00. Not offered 2001–2002. Staff.
An analysis of the distribution and use of public and private resources for educational purposes. Discussion revolves around the issues of equity, efficiency, and freedom of choice. Alternative methods of financing schools are evaluated, and the perplexing legal and moral issues raised by such questions as "Who pays?" and "Who benefits?" are discussed. Specific attention is given to budgeting, accountability, and productivity. An opportunity for individuals to focus on their own areas of interest, such as occupational education, the two-year college, or secondary or higher education.]

EDUC 665 Administrative Decision Making
Spring. 3 credits. S-U grades optional. W 3:35–6:00. Staff.
An introduction to decision-making theory and its relevance to the field of educational administration. Specific applications are made to the study and improvement of productivity in educational systems. A wide variety of educational settings are considered, including K-12, higher education and nonformal education.

EDUC 680 Foundations of Extension Adult Education
Fall. 3 credits. Limited to 20 students. S-U grades optional. R 3:35–6:00. A. Wilson.
An analysis of alternative purposes, nature, and scope of extension, adult, and continuing education programs in the United States and abroad, with emphasis on the relationship of programs to historical, cultural, political, and social settings. Definitions, conceptual controversies, philosophical issues, and current research directions are examined through a seminar approach.

EDUC 682 Community Education and Development
Fall. 3 credits. Limited to 25 students. Letter grade only. M 1:25–4:25. S. Peters.
An examination of the concept of community; changes in community life; the analysis of community; alternative strategies for community development; patterns of response to community by universities, colleges, schools, cooperative extension, and government service agencies; and such functional dimensions of community education programming as participatory decision making, volunteers, leadership development, council formation and function, interagency coordination, and change-agents roles.

EDUC 685 Training and Development: Theory and Practice (also COMM 685, INTAG 685)
Spring. 4 credits. S-U grades optional. F 9:05–12:05; lab TBA. M. Kroma.
Analysis, design, conduct, administration, and evaluation of training programs for the development of human resources in small-farm agriculture, rural health and nutrition, literacy and nonformal education, and general community development. Designed for scientists, administrators, educator-trainers, and social organizers in rural and agricultural development programs in the United States and abroad.

EDUC 694 Special Topics in Education
Fall, spring, or summer. 1–3 credits. Prerequisite: permission of instructor. S-U grades optional. Hours TBA. Staff.
Topics to be announced.

EDUC 711 Contemporary Issues in Educational Psychology
Fall and spring. Variable, 3 credits. TBA. Staff.
This is a graduate-level seminar dealing with key issues in contemporary psychology having implications for educational practice and research. Topics vary from semester to semester. Students may take the course more than once.

[EDUC 714 Moral Development and Education
Spring. 3 credits. S-U grades optional. M 12:20–2:15. Offered alternate years. Not offered 2001–2002. D. E. Schrader.
This seminar focuses on current topics in moral development research as related to the educational process. Topics include the question of the development of moral reasoning, gender differences, the relationship between moral judgment and moral action, questions related to moral education in secondary schools and university settings, and professional ethics in educational settings. This course takes a life-span perspective; however, special emphasis is placed on development from adolescence through adulthood.]

EDUC 718 Adult Learning and Development
Spring. 3 credits. Prerequisite: permission of instructor. S-U grades optional. W 2:00–4:25. A. Wilson and R. E. Ripple.
Deals with adult development and learning behavior from points of view of educational psychology and adult education. Inferences are drawn from theory and research to the practice of adult continuing education. Appropriate for graduate students in educational psychology, extension and continuing education, and community service education, and for others interested in adult learning and development.

EDUC 730 Seminar in Agricultural, Extension, and Adult Education
Spring. 3 credits. S-U grades optional. R 8:00–9:55. S. Peters.
Emphasis is on current problems and research in agricultural, extension, and adult education. Includes discussion and analysis of student and staff research.

[EDUC 745 Seminar in Curriculum Theory and Research
Fall. 3 credits. Prerequisite: EDUC 644, or permission of instructor. Not offered 2001–2002. T 2:30–5:00. G. J. Posner.
Theoretical issues in curriculum and appropriate areas for curriculum research are discussed. Two current topics of interest are the hidden curriculum and school reform. Both topics serve to uncover the relation between ideology and research.]

EDUC 760 Practicum Seminar in Educational Administration
Fall, spring, and summer. 2 credits. S-U only. Hours TBA. J. W. Sipple.
The practicum seminar is taken in conjunction with the administrative internship and serves to tie together previous coursework, current policy issues, and the concurrent internship. It involves two elements. First, current interns meet regularly during the semester to bring their knowledge base (developed in the program) to bear on their current duties and problems and collaboratively problem solve with faculty and other interns. Second, interns participate in special topics seminars as needed in order to supplement coursework in critical areas. Examples of special topics are AIDS, sexual harrassment in the workplace, child abuse, and substance abuse recognition.

EDUC 761 Internship in Educational Administration
Fall, spring, and summer. 9 credits. S-U only. Hours TBA. G. Posner and J. W. Sipple.
The internship experience provides aspiring administrators with supervised professional activities in a public school district. Students undertaking an internship in Educational Administration (1) learn the practical day-to-day skills of school administration under the supervision of an on-site administrator, and (2) conceptualize and execute a research project dealing with an issue of interest to the participating school district and the student's special committee. Students work in collaboration with their special committee and on-site supervisor to integrate educational theory and the field experience. A minimum of 20 hours per week are devoted to on-site internship duties. Students enroll concurrently in EDUC 760 (practicum seminar) to complete additional degree and certification requirements.

EDUC 762 Comparative Educational Systems
Fall. 3 credits. S-U grades optional. M 10:10–12:35. N. Assie-Lumumba.
This seminar critically analyzes education conceived both as a universal social institution and a reflection of cultural, economic, and political dynamics of the local and global contexts. The analysis focuses on policies, organization, and the functioning of education in industrial, new/emerging economies and developing countries. Specific case studies are drawn from different countries.

EDUC 783 Farmer-Centered Research and Extension (also INTAG 783)
Fall. 3 credits. S-U option. M. Kroma.
This course provides an introduction to participatory traditions in farming systems research, extension, evaluation of rural development, technology generation, gender analysis, participatory rural appraisal, and documentation of local and indigenous knowledge of community-based development. Case studies of farmer-centered research and extension provide a focus for analysis. Appropriate roles of researchers and extensionists as partners with farmers are examined. A major contribution of farmer-centered research and extensions is its potential to legitimize people's knowledge by enhancing their capacity to critically analyze their own problems, to conduct their own research, and to empower them to take direct action to solve those problems.

EDUC 800 Master's-Level Thesis Research
Fall or spring. Credit TBA. S-U grades optional. Each student, before course enrollment, must obtain the approval of a faculty member who will assume responsibility for guiding the work. Hours TBA. Staff.

EDUC 900 Doctoral-Level Thesis Research
Fall or spring. Credit TBA. Limited to students working on theses or other research and development projects. S-U grades optional. Each student, before

course enrollment, must obtain the approval of a faculty member who will assume responsibility for guiding the work. Hours TBA. Staff.

ENTOMOLOGY

D. A. Rutz, chair; A. M. Agnello, M. C. Caillaud, N. W. Calderone, B. N. Danforth, G. M. English-Loeb, J. Ewer, P. P. Feeny, C. Gilbert, A. E. Hajek, L. C. Harrington, M. P. Hoffmann, J. K. Liebherr, J. E. Losey, J. P. Nyrop, B. L. Peckarsky, D. Pimentel, L. S. Rayor, R. B. Root, J. P. Sanderson, J. G. Scott, A. M. Shelton, E. J. Shields, W. M. Tingey, M. Villani, P. A. Weston, Q. D. Wheeler

Courses by Subject

Apiculture: 260, 264
Behavior: 215, 325, 394, 471, 662
Ecology: 452, 455, 456, 470, 471, 672
Introductory courses: 201, 212, 215
Medical entomology and veterinary entomology: 352
Morphology: 322
Pathology: 463
Pest management: 241, 277, 441, 443, 444, 477, 644
Physiology, development and toxicology: 370, 394, 400, 483, 490, 685
Systematics: 331, 453, 631, 632, 634, 635

Note: class meeting times are accurate at the time of publication. If changes are necessary, the department will provide new information as soon as possible.

ENTOM 201 Alien Empire: Bizarre Biology of Bugs
Spring. 2 credits. Limited to 100 students. S-U grades optional. Lecs, T R 9:05; optional field trips, required lab demonstrations. Offered alternate years. B. N. Danforth.
Insects are the most abundant and diverse animals on earth. This course explores the bizarre biology of insects by examining their evolutionary history, anatomy, development, feeding habits, life-history strategies, behavior, and their interactions with humans (both positive and negative) through history. Optional field trips and one open lab provide hands-on opportunities for examining these amazing animals.

ENTOM 212 Insect Biology
Fall. 4 credits. Prerequisites: BIO G 101–102 (may be taken concurrently) or equivalent. Lecs, W F 10:10–11:00; labs T W or R 1:25–4:25. Lab fee $35. C. Gilbert.
Introduces the science of entomology by focusing on basic principles of systematics, morphology, physiology, behavior, and ecology of insects. The laboratory in early fall includes field trips to collect and study insects in the natural environment. A collection emphasizing ecological, behavioral, and taxonomic categories is required.

ENTOM 215 Spider Biology: Life on a Silken Thread
Fall. 2 credits. Prerequisite: introductory biology or permission of instructor. S-U grades optional. Lecs, W F 1:25–2:15. L. S. Rayor.
An introduction to the fascinating world of spiders. Evolution, ecology, behavior, and physiology of spiders and their close kin are explored from a modern perspective. Topics include identification of major spider families, spiders' unique use of silk, risky courtship, predatory behavior, diverse life styles, social spiders, and potential use in IPM.

ENTOM 241 Applied Entomology
Spring. 3 credits. Prerequisites: BIO G 101–102 or equivalent. Lecs, T R 10:10; lab/disc, T or W 12:20–3:15. W. M. Tingey.
Introduction to major pest species and tactics for their management. Discussions of insect pest management requirements on farms, gardens, forests, and urban environments, along with descriptions of control methods, materials, and equipment.

ENTOM 260 Introductory Beekeeping
Fall. 2 credits. Lecs, T R 11:15. N. W. Calderone.
Introduces students to the life history, physiology, and behavior of honey bees, as well as to the fundamentals of practical beekeeping. Classical and contemporary research on the dance language, chemical communication, behavioral genetics, division of labor, and evolution of social behavior are reviewed. Lectures on pollination of agricultural crops, honey and beeswax, bees in ancient and modern rituals, Africanized honey bees, and insect politics are also included.

ENTOM 264 Practical Beekeeping
Fall. 1 credit. Limited to 20 students. Prerequisite: ENTOM 260 (may be taken concurrently). Lab, R 2–4:25. N. W. Calderone.
This course consists of 14 laboratory sessions that acquaint students with practical methods of colony management. Laboratories involve hands-on work with honey bee colonies and equipment. Some of the topics covered include management of bees for apple pollination, honey harvesting and processing, and disease identification/control. The class makes a number of field trips to commercial beekeeping operations. Students conduct simple experiments to demonstrate color perception by bees, as well as the chemical basis for swarming, nest guarding, and mating.

[ENTOM 277 Natural Enemies Managing Pests: An Introduction to Biological Control
Spring. 2 credits. S-U grades optional. Lecs, T R 1:25–2:15; lab demonstration; optional field trip. Offered alternate years. Not offered spring 2002; next offered spring 2003. A. E. Hajek.
An introduction to the dynamic field of biological control. What is it and when should it be used? This course covers a diversity of types of biological control including use of parasitoids, predators, pathogens, and competitors as well as plant breeding to control pests from microbes to weeds to invertebrates and vertebrates. This course is intended for students curious about safely controlling pests.]

[ENTOM 322 Comparative Insect Morphology
Spring. 5 credits. Prerequisite: ENTOM 212 or 241. Lecs, M W F 9:05; labs, M W 1:25–4:25. Offered alternate years. Not offered spring 2002; next offered spring 2003. B. N. Danforth.
This course provides a detailed introduction to the external and internal anatomy of insects. Lectures introduce basic concepts in insect morphology, such as the organization of the insect body plan and organ systems, functional morphology, homology, phylogeny, modularity, and development. The laboratory portion of the course introduces students to the basic methods of insect microdissection, specimen preparation, and scientific illustration. High-quality, publishable illustrations are produced based on student art-work.]

[ENTOM 325 Insect Behavior
Spring. 3 credits. Prerequisites: introductory biology or introductory entomology or permission of instructor. Lecs, M W F 12:20. Offered alternate years. Not offered spring 2002; next offered spring 2003. L. S. Rayor.
Insects are the most diverse organisms on earth, with equally diverse behavior. This course explores the behavior of insects, ranging from the individual sensory and physiological mechanisms that are the basis of insect behavior, to the behavioral dynamics of foraging, courtship, parental care, and social behavior. Topics include insect learning, perceptual abilities, host finding strategies, predation, pollination, and examination of current issues in insect behavior.]

ENTOM 331 Introductory Insect Systematics
Fall. 4 credits. Prerequisite: ENTOM 212. Lecs, T R 12:20; labs, T R 1:25–4:25. Lab fee $50. Offered alternate years. C. J. Marshall.
An introduction to the classification, evolutionary history, and distribution of the insects. Laboratory practice in the identification of orders, families, and representative genera of insects; methods of collection, preservation, and study. Lectures on theory and practice of insect systematics and major features of insect evolution. Insect collections are required.

[ENTOM 370 Pesticides, the Environment, and Human Health (also TOX 370)
Fall. 2 credits. Prerequisites: BIO G 101–102 or equivalent. Lecs, T R 9:05. Offered alternate years. Not offered fall 2001; next offered fall 2002. J. G. Scott.
A survey of the different types of pesticides, their uses, properties, and effects on the environment. Discussion of the risks, benefits, regulation, politics, and current controversies associated with pesticide use.]

ENTOM 394 Circadian Rhythms (also BIOGD 394 and BIONB 394)
Fall. 2 credits. Prerequisite: ENTOM 212, or BIOGD 281, or BIONB 221 or 222, or permission of instructor. S-U grades optional. Lec, W 7:30–9:10 P.M. Offered alternate years. J. Ewer.
This course explores the neural, endocrine, and molecular mechanisms by which organisms "keep time," and how their clocks are synchronized with the planet's 24 hour light and temperature cycles. The course leans heavily on the knowledge obtained from the analysis of rhythms in insects, especially *Drosophila*, but also includes an in-depth analysis of circadian rhythms in other organisms, from cyanobacteria to mammals.

ENTOM 400 Insect Development (also BIOGD 402)
Spring. 4 credits. ENTOM 212 or BIOGD 281 or permission of instructor. S-U grades optional. Lecs, M W 11:15; lab, M 12:20–3:20; disc, F 11:15–12:05. Offered alternate years. J. Ewer.
The course emphasizes the mechanisms that underlie embryonic and post-embryonic developmental processes of insects. The portion of the course on embryonic develop-

ment leans heavily on knowledge obtained from *Drosophila*, but also covers more classical studies as well as recent advances exploring the molecular basis for the evolution of body plan. The post-embryonic development portion covers the control of growth, molting, and metamorphosis. The laboratory uses modern techniques to illustrate developmental events at the organismal and cellular level. The discussion section involves the analysis and presentation of primary research papers.

[ENTOM 441 Seminar in Insect Pest Management

Spring. 1 credit. Limited to 15 students. Prerequisite: ENTOM 241 or 444 or permission of instructor. S-U grades only. Hours TBA. Offered alternate years. Not offered spring 2002; next offered spring 2003. M. P. Hoffmann and A. M. Shelton.

Discussion and analysis of current topics in insect pest management.]

[ENTOM 443 Entomology and Pathology of Trees and Shrubs (also PL PA 443)

Fall. 4 credits. Prerequisites: ENTOM 212 or equivalent and PL PA 241 or equivalent. S-U grades optional. Evening prelims. Lecs, M W F 11:15; lab, F 1:25-4:25. Offered alternate years. Not offered fall 2001; next offered fall 2002. P. A. Weston and G. W. Hudler.

For students preparing for careers in horticulture, urban forestry, pest management, and natural history/science education. Deals with the nature, diagnosis, assessment, and management of insect and disease pests on trees and shrubs in forests, urban landscapes, Christmas tree plantations, and other sites where intensive pest management is practiced.]

ENTOM 444 Integrated Pest Management (also PL PA 444)

Fall. 4 credits. Prerequisites: BIOEE 261, ENTOM 212 or 241, and PL PA 241 or their equivalents or permission of instructor. Lecs, M W F 9:05; labs, M 1:25–4:25. P. Arneson and J. Losey.

Lectures integrate the principles of pest control, ecology, and economics in the management of pests across multiple systems. Laboratories consist of exercises to reinforce concepts presented in lecture and demonstrate pest monitoring techniques and the application of computer technology to management problems.

[ENTOM 452 Herbivores and Plants: Chemical Ecology and Coevolution (also BIOEE 452)

Spring. 3 credits. Prerequisites: 1 year of introductory biology; BIOEE 261; CHEM 257 or 357/358 and 251 or 301; or permission of instructor. Lecs, M W F 11:15. Offered alternate years. Not offered spring 2002; next offered spring 2003. P. P. Feeny.

Significance of plant chemistry in mediating interactions between plants and herbivorous animals; mechanisms and strategies of plant finding and exploitation by animals, especially insects, and of defense and escape by plants; evolutionary hypotheses for ecological patterns of resistance and attack; implications for human food and agriculture.]

ENTOM 453 Principles and Practice of Historical Biogeography (also BIOPL 453)

Fall. 3 credits. Prerequisite: a course in systematics or permission of instructors. S-U grades optional. Lecs, T R 10:10; lab T 1:25–4:25. Offered alternate years. J. K. Liebherr and M. Luckow.

A survey of techniques in historical biogeography, and the development of modern biogeographic theory in the context of classical, ecological, and phylogenetic analytical methods. Geological and paleontological aspects of biogeography are presented, and large-scale biogeographic patterns discussed. Laboratories focus on computer applications and discussion of controversial issues.

ENTOM 455 Insect Ecology (also BIOEE 455)

Fall. 3 credits. Prerequisites: BIOEE 261 or equivalent and ENTOM 212 or equivalent knowledge of another taxon. S-U grades optional. Lecs, M W F 11:15. Offered alternate years. R. B. Root.

Topics include the nature and consequences of biotic diversity, biogeography, coevolution, adaptive syndromes exhibited by various guilds, population regulation, impact of insects on ecosystems, comparative and functional analysis of communities, and differences in the organization of natural and managed systems. Ecological and evolutionary principles are integrated by thorough study of exemplars.

[ENTOM 456 Stream Ecology (also BIOEE 456 and NTRES 456)

Spring. 4 credits. Limited to 60 students. Recommended: BIOEE 261. S-U grades optional. Lecs, T R 9:05; labs, T W or R 1:25–4:25. Offered alternate years. Not offered spring 2002; next offered spring 2003. B. L. Peckarsky.

Lecture addresses the patterns and processes occurring in stream ecosystems, including channel formation, water chemistry, watershed influences, plant, invertebrate, and fish community structure, nutrient cycling, trophic dynamics, colonization and succession, community dynamics, conservation, and the impacts of disturbances. Lab: field projects include descriptive and experimental techniques, hypothesis testing and writing of scientific papers related to environmental assessment.]

ENTOM 463 Invertebrate Pathology

Spring. 4 credits. Prerequisites: one year of introductory biology. S-U grades optional. Lecs, M W F 9:05; lab, W 1:25–4:25. Offered alternate years. A. E. Hajek.

Lecture presents principles of pathology as applied to invertebrates. Topics explored include noninfectious and infectious diseases caused by viruses, bacteria, fungi, protozoa, and nematodes, epizootiology of insect diseases, and use of pathogens for control. Laboratory involves a diversity of pathogens and hosts using techniques such as microinjection, electrophoresis, immunoassay, density gradient centrifugation, soil extraction, and computer simulation.

[ENTOM 470 Ecological Genetics

Spring. 3 credits. Prerequisites: BIOEE 278 or permission of instructor. S-U grades optional. Lecs, T R 10:10; disc, 1 hr/wk TBA. Offered alternate years. Not offered spring 2002; next offered spring 2003. Staff.

A study of the genetic basis and evolution of ecologically important traits. Blending theory with an experimental approach to study evolution in nature, the course includes methods for measuring genetic variation and natural selection; biometrical and molecular analysis of genetic architecture; constraints and limits on evolution in natural populations; genetic aspects of coevolution, phenotypic plasticity, and conservation of endangered species. Examples are taken from studies of animals and plants.]

ENTOM 471 Freshwater Invertebrate Biology and Biomonitoring

Spring. 5 credits. Recommended: ENTOM 212. S-U grades optional. Lecs, T R 9:05; labs, T R 1:25–4:25. Offered alternate years. B. L. Peckarsky.

Lecture explores the morphology, physiology, phylogeny, life histories, behavior, feeding ecology, and evolution of macroscopic freshwater invertebrates with an emphasis on contrasting the attributes of aquatic and terrestrial insects. Laboratory involves field collections and identification of invertebrates and stresses the use of taxonomic keys. Students prepare a collection of freshwater invertebrates or conduct a project using freshwater invertebrates to biomonitor stream habitat quality.

[ENTOM 477 Biological Control

Fall. 3 credits. Prerequisites: ENTOM 212, BIOEE 261, and permission of instructor. Lecs, T R 9:05; lab T 1:25–4:15. Offered alternate years. Not offered fall 2001; next offered fall 2003. Staff.

Approach and procedures in biological control of arthropod pests and weeds. Demonstrations focus on living parasitoids and predators. Discussions focus on case histories.]

[ENTOM 483 Insect Physiology

Fall. 5 credits. Prerequisite: ENTOM 212 or permission of instructor. Lecs, M W F 11:15; lab W 1:25–4:25 and a disc, TBA. Offered alternate years. Not offered fall 2001; next offered fall 2002. C. Gilbert.

An introduction to the often unique ways in which insects have met their basic needs. Each organ system is examined with emphasis on basic principles and specific examples. Students are also introduced to some common methods used in physiological research and to the critical reading of scientific literature.]

[ENTOM 490 Toxicology of Insecticides (also TOX 490)

Spring. 4 credits. Prerequisites: general chemistry. S-U grades optional. Lecs, M W F 9:05; disc 1:25–2:15, day TBA. Offered alternate years. Not offered spring 2002; next offered spring 2003. J. G. Scott.

The history, metabolism, and mechanism of action of synthetic and naturally occurring insecticides. Mechanisms of insecticide resistance, evaluation of insecticide toxicity, and new approaches to insect control with biotechnology are discussed.]

ENTOM 494 Special Topics in Entomology

Fall or spring. 4 credits maximum. S-U grades optional. Hours TBA. Staff.

The department teaches "trial" courses under this number. Offerings vary by semester, and are advertised by the department before the semester starts. Courses offered under the number will be approved by the department curriculum committee, and the same course is not be offered more than twice under this number.

ENTOM 497 Individual Study in Entomology
Fall or spring. Credit TBA. Prerequisite: permission of instructor. Students must register with an Independent Study form (available in 140 Roberts Hall). Staff.

ENTOM 498 Undergraduate Teaching
Fall or spring. Credit TBA. Prerequisite: permission of instructor. Undergraduate teaching assistance in an entomology course by agreement with the instructor. Students must register with an Independent Study form (available in 140 Roberts Hall). Staff.
Participating students assist in teaching a course allied with their education and experience. Students are expected to meet regularly with a discussion or laboratory section, to gain teaching experience, and regularly to discuss teaching objectives, techniques, and subject matter with the professor in charge.

[ENTOM 631 Systematics of the Coleoptera
Summer. 3 credits. Limited to 18 students. 3 week summer session. Prerequisites: an introductory course in insect taxonomy and permission of instructor. Labs, M T W R F 9–4; Saturday field trips. Offered alternate years. Not offered 2001; next offered 2002. Q. D. Wheeler.
A comprehensive review of the comparative morphology, phylogenetic relationships, classification, natural history, and distribution of the Coleoptera, including adult and immature stages. Laboratory practice in identification and methods for collection and study of beetles. A collection is required.]

[ENTOM 632 Advanced Coleopterology
Summer. 1–3 credits. Prerequisite: permission of instructor. S-U grades optional. Lab, TBA. Offered alternate years. Not offered 2001; next offered 2002. Q. D. Wheeler.
An advanced course on the phylogeny and classification of selected subclades of Coleoptera. Laboratory exercises in identification of beetles, generally to the level of genus or beyond. Taught by authority on taxon of interest, frequently including a visiting scholar. Can be repeated for credit.]

ENTOM 634 Special Topics in Systematic Entomology
Fall or spring; taught on demand. 2–4 credits. Prerequisite: permission of instructor. Staff.
Lectures on the classification, evolution, and bionomics of selected taxa, with accompanying laboratory studies on identification and comparative morphology. Collections sometimes required.

[ENTOM 635 Insect Molecular Systematics
Spring. 2 credits. Prerequisites: permission of instructor. Offered alternate years. Not offered spring 2002; next offered spring 2003. TBA. Limited to 6 students. B. N. Danforth.
Analysis of DNA sequence variation can provide a powerful tool for resolving problems in insect systematics, from species level taxonomic decisions to higher level (ordinal) relationships. This course introduces students to the basic methods of insect molecular systematics, including DNA extraction, gel electrophoresis, PCR, DNA purification, and DNA sequencing (manual and automated). Results are analyzed using available computer programs. Students are encouraged to collect preliminary data for thesis or post-doctoral research.]

ENTOM 644 Advanced IPM: Theory and Implementation
Spring. 1–4 credits. S-U grades optional. Lecs, M W F 10:10. Coordinator: J. E. Losey.
This advanced course in integrated pest management (IPM) is comprised of a rotating series of four-week intensive modules on specialized topics. Topics range from basic ecology and genetics of pests and their natural enemies to specific strategies for pest management implementation. The course is designed to provide advanced IPM instruction for graduate and upper-level undergraduate students with intermediate backgrounds in IPM. In special cases, students with little or no background in IPM seeking intensive instruction on a specialized topic may enroll with permission of the instructor. Each module is a unique unit and students may take any or all modules each time the course is offered. Prerequisites and grading procedures are determined by the instructor(s) of each module. Potential modules include: Insecticide resistance and resistance management—J. Scott: Entomology (Ithaca); Crop protection decision making—J. Nyrop: Entomology (Geneva); Economics of pest management—Staff: AEM; Greenhouse and Floriculture IPM—J. Sanderson: Entomology (Ithaca); IPM in fruit systems—A. Agnello, G. English-Loeb: Entomology (Geneva); Genetics in managed ecosystems—M. C. Caillaud: Entomology (Ithaca); Turf-grass insect IPM—M. Villani: Entomology (Geneva); Insect vectors of plant pathogens—Staff; IPM of soil-dwelling arthropods—M. Villani: Entomology (Geneva); Integrated weed and insect pest management—C. Mohler: Ecology & Evolutionary Biology; IPM implementation and extension—M. Hoffmann, J. Sanderson: Entomology (Ithaca); Plant resistance—Staff: Entomology, Plant Breeding; Integrated Pest Management in Tropical Agriculture—P. Arneson: Plant Pathology (also PL PA 655); IPM of natural systems—B. Blossey: Natural Resources; and Sustainable strategies for pest management—Staff.

[ENTOM 662 Insect Behavior Seminar
Spring. 2 credits. Prerequisites: permission of instructor and ENTOM 212 and BIONB 221 or equivalents. S-U grades optional. Offered alternate years. Not offered spring 2002; next offered spring 2003. Hours TBA. Staff.]

[ENTOM 672 Seminar in Aquatic Ecology
Spring. 1 credit. Prerequisites: permission of instructor or either ENTOM 456, 471, or BIOEE 261, 462. S-U grades optional. Hours TBA. Offered alternate years. Not offered spring 2002; next offered spring 2003. B. L. Peckarsky.
Discussion and analysis of current topics in the ecology of streams, lakes, and marine ecosystems, including student-generated synthesis of key papers in the literature. Generally appropriate for graduate students only. Interested undergraduates must contact the instructor.]

[ENTOM 685 Seminar in Insect Physiology
Spring. 1 credit. S-U grades optional. Prerequisite: permission of instructor. Offered alternate years. Not offered spring 2002; next offered spring 2003. Hours TBA. C. Gilbert.]

ENTOM 707 Individual Study for Graduate Students
Fall or spring. Credit TBA. Prerequisite: permission of instructor. Not for thesis research. Staff.

ENTOM 709 Teaching Entomology
Credit TBA. Staff.
Teaching entomology or for extension training.

ENTOM 767 Current Topics in Entomology
Fall. 1 credit. Required of graduate students pursuing a degree in the Field of Entomology. Lecs and disc, TBA. Staff.
This course provides lectures, readings and discussion to introduce first-year graduate students to the research activities of faculty in the Graduate Field of Entomology. Class meets weekly for one hour.

ENTOM 800 Master's-Level Thesis Research
Credit TBA. Prerequisite: permission of instructor. S-U grades optional. Staff.

ENTOM 900 Doctoral-Level Thesis Research
Credit TBA. Prerequisite: permission of instructor. S-U grades optional. Staff.

Jugatae Seminar
Fall and spring.
A seminar conducted by Jugatae, the entomology club of Cornell University, to discuss topics of interest to its members and guests. All interested undergraduate and graduate students are encouraged to attend.

FLORICULTURE AND ORNAMENTAL HORTICULTURE

See Horticulture.

Freehand Drawing and Scientific Illustration

Freehand Drawing and Scientific Illustration courses are offered through the Department of Horticulture and are described in the section "Freehand Drawing and Scientific Illustration."

FOOD SCIENCE

D. D. Miller, chair; T. E. Acree, D. K. Bandler, D. M. Barbano, C. A. Batt, K. J. Boor, M. C. Bourne, J. W. Brady, D.P. Brown, J. M. Brown, R. B. Gravani, T. Henick-Kling, J. H. Hotchkiss, H. T. Lawless, C. Y. Lee, R. H. Liu, S. J. Mulvaney, J. M. Regenstein, S. S. H. Rizvi, J. S. Roberts, K. J. Siebert, M. Wiedmann.

Note: class meeting times are accurate at the time of publication. If changes are necessary, the department will provide new information as soon as possible.

FOOD 101 Science and Technology of Foods
Fall. 1 credit. S-U grades only. M 1:25–2:15. J. H. Hotchkiss and staff.
This course explores the application of science and technology to foods. Lectures will elucidate the role of engineering, biotechnology, chemistry, biochemistry, nutrition, toxicology, and microbiology in supplying the world with safe and nutritious food. An overview of food science as a discipline and career choice is given.

FOOD 102 Exploring Food Processing
Spring. 1 credit. S-U grades only. F 12:20. 5 field trips, 1 on F 12:30–2:30 and 4 on F 12:30-5:30. D. P. Brown.
A series of seminars on current technological and regulatory developments in food science. Field trips to four commercial food manufacturing/processing plants and one food research organization are used to illustrate the application of current technologies. A course project, using the Food Science Alumni Network, is required.

FOOD 150 Food Choices and Issues
Spring. 2 credits. S-U grades optional. T R 12:20. R. B. Gravani and D. D. Miller.
This course provides Cornell students with the knowledge needed to make healthy food choices. Topics include the U.S. food system; relationships between diet and health; food processing; food safety; and discussions of contemporary issues relating to food quality, safety, and nutrition. Students assess the nutritional quality of their personal diets and learn how to make changes to improve their diets.

FOOD 200 Introductory Food Science
Fall. 3 credits. Prerequisite: college-level courses in chemistry and biology. M W F 11:15–12:05. J. H. Hotchkiss.
A comprehensive introduction to the principles and practice of food science and technology. Topics include: chemistry of foods; nutritional significance; food formulation, preservation, and processing; microbiology and fermentations; composition and processing of food commodities; and contemporary issues including food safety, regulation, and world food needs. Interrelationships between the chemical, physical, nutritional, and quality properties of foods as affected by formulation, processing, and packaging are stressed.

FOOD 210 Food Analysis
Spring. 3 credits. Prerequisite: CHEM 208 or equivalent. Lecs, W F 1:25–2:15; lab, M 12:20–3:20. R. H. Liu and J. M. Brown.
Introduces basic analytical techniques for food analysis and other biological analysis. Emphasizes fundamental principles of analytical chemistry, basic laboratory techniques, and modern instrumental methods. Gravimetric, volumetric, and spectrophotometric methods; gas chromatography (GC); high-performance liquid chromatography (HPLC); infrared spectra (IR); and atomic absorption spectrometry are discussed.

FOOD 250 Kosher and Halal Food Regulations
Spring. 2 credits. Sophomore standing and above. M 7:30–9:25 P.M. J. M. Regenstein.
A comprehensive introduction to kosher and halal foods in the American food industry with some coverage of home practices. The kosher food laws, their origin, and their application in modern food processing are examined. The nature of the kosher supervision industry in America is described. Halal laws are also examined and the interactions between the two communities explored. Current food-related issues in both communities are reviewed, including recent court decisions. Some aspects of ethnic foods are also considered.

FOOD 290 Meat Science (also AN SC 290)
Fall. 2 or 3 credits. Lecs, T R 11:15; lab M or R 12:20–3:20. Lab cannot be taken without lecture. D. E. Shaw.
An introduction to meat science through a study of the structure, composition, and function of muscle and its conversion to meat. Properties of fresh and processed meat, microbiology, preservations, nutritive value, inspection, and sanitation are also studied. Laboratory exercises include anatomy, meat-animal slaughter, meat cutting, wholesale and retail cut identification, processing, inspection, grading, quality control, and meat merchandising. An all-day field trip to commercial meat plants is taken.

FOOD 321 Food Engineering Principles
Fall. 3 credits. Prerequisites: FOOD 200 and introductory physics. M W F 9:05–9:55. S. S. H. Rizvi.
Introduces the engineering principles underlying food processes and equipment. Topics covered include thermodynamics, mass and energy balance, fluid mechanics, heat and mass transport, and refrigeration and psychrometrics.

FOOD 351 Milk Quality
Fall. 1 credit. Prerequisite: AN SCI 250 or equivalent or permission of instructor. F 12:20. M. Wiedmann.
This course focuses on the effects of on-farm and animal husbandry practices on milk and dairy food quality and safety. Significant parts of class focus on discussion and critical analysis of the assigned reading materials, questions, and hot topics.

FOOD 394 Applied and Food Microbiology (also BIOMI 394)
Fall. 2–3 credits. Prerequisites: BIOMI 290–291. M W F 12:20–1:10. C. A. Batt.
Microorganisms play a central role in a variety of food, agricultural, and environmental processes. This course presents a comprehensive survey of the roles that microorganisms play in industrial/biotechnological processes as well as their importance in the safety and production of foods. Issues related to the biochemistry, genetics, and physiology of microorganisms important in these processes are reviewed. A two-credit core section on food microbiology is complemented by a one-credit section on industrial/biotechnology applications.

FOOD 395 Food Microbiology Laboratory
Fall. 2 credits. Prerequisite: BIOMI 291 or equivalent. M W 2:00–4:25. J. M. Brown.
Work includes study of the physiological characteristics of representative food microorganisms, practice in using general and rapid methods for microbiological testing and control of food products, and practice in the application of a systematic approach to controlling the safety of foods, or addressing a food safety issue.

[FOOD 396 Food Safety Assurance
Spring. 2 credits. Prerequisite: MICRO 290 or permission of instructor. T R 9:05–9:55. Offered alternate years. Not offered 2002, 2004, next offered spring 2003. R. B. Gravani.
This course provides information on procedures to control biological, chemical, and physical hazards and assure the safety of foods. Topics include discussions on the Hazard Analysis Critical Control Point (HACCP) concept, good manufacturing practices, prerequisite programs, and the application of current technologies in reducing the risk of foodborne illnesses. Case studies and exercises are used to demonstrate and apply the key principles that are discussed.]

FOOD 400 Senior Seminar in Food Science and Technology
Fall. 1 credit. Limited to seniors. M 4:30–5:20. D. K. Bandler.
Students prepare and present a seminar on a topic of current interest in food science and technology.

[FOOD 401 Concepts of Product Development
Spring. 2 credits. Prerequisite: FOOD 200 or equivalent. M W 11:15–12:05. Offered alternate years. Not offered 2002, 2004, next offered 2003. J. H. Hotchkiss.
A discussion of the sequence of events in developing and marketing new food products. Topics include food formulation, packaging and labeling, food additive and ingredient regulations, taste panels, market testing, market research, and patents.]

[FOOD 405 Managing Food Waste without Trashing the Environment
Spring. 2 credits. Prerequisite: FOOD 200 or its equivalent. Lec, M 12:30–2:15; lab, M 2:30–4:25. Offered alternate years. Not offered 2002, 2004, next offered spring 2003. J. M. Regenstein.
A look at the various waste streams generated by food plants, institutional feeders, supermarkets, and restaurants. What is the role of waste minimization? What technologies can control or remediate the problems? What are the disposal, composting, and recycling options? What are the legal requirements locally, statewide, and nationally that affect various food waste processes? This course serves as a general introduction to available waste management technologies and to policy issues faced by a wide range of businesses and production plants.]

FOOD 406 Dairy and Food Fermentations
Fall. 2 credits. Prerequisite: BIOMI 290. Letter grades only. R 12:20–2:15. M. Wiedmann.
This is a lecture course covering the basic principles of fermentation, the microbiology of food fermentations (including the physiology and genetics of fermentative microorganisms), starter cultures and their preparations and applications as well as specific examples of food fermentations. Selected textbook readings are supplemented with papers from peer-reviewed journals. Significant parts of class focus on discussion and critical analysis of the assigned reading materials, questions and hot topics.

FOOD 410 Sensory Evaluation of Food
Fall. 2–3 credits (1 lab credit). Prerequisite: statistics. Lec, T R 9:05–9:55; lab, F 1:25–4:25. H. T. Lawless.
Topics include the sensory evaluation methods used to test the flavor, appearance,

and texture of foods by quantitative description and simple difference testing; consumer testing for product acceptability; sensory tests in quality control; strategic product research; and product development. The psychological principles in sensory testing and statistical methods for sensory data analysis are presented. The laboratory provides first hand experience in organizing and conducting sensory tests and an introduction to online date collection and analysis. Undergraduate Food Science majors are required to take both the lecture and the laboratory.

FOOD 415 Principles of Food Packaging
Spring. 3 credits. M W F 9:05–9:55. Offered alternate years. Next offered spring 2002 and 2004; not offered spring 2003. J. H. Hotchkiss.
The chemical and physical properties and manufacture of the basic materials used to construct packaging are discussed. The influence of packaging on shelf life is presented. Emphasis is on newer packaging technologies and materials. Economics, design, and regulation of food packaging are briefly presented.

FOOD 417–418 Food Chemistry I and II
Spring 417; fall 418. 3 credits, spring; 2 credits, fall. Prerequisites: CHEM 257 or BIOBM 330 or 331. S-U or letter grade. FOOD 417, M W F 9:05; FOOD 418, M W 9:05. Both courses will be offered in 2001–2002. J. W. Brady.
A course on the chemistry of food and food ingredients. Chemical and physical properties of water, proteins, lipids, carbohydrates, and other food components/additives are discussed in the context of their interactions and functional roles in foods. The effects of chemical changes during processing and storage on quality and nutritional aspects of several food commodity groups (milk, meat, fruits and vegetables, cereals and legumes) are described.

FOOD 419 Food Chemistry Laboratory
Spring. 2 credits. Prerequisites: CHEM 257 or BIOBM 330 or 331 and concurrent registration in FOOD 417. W 12:20–4:25. D. D. Miller and J. M. Brown.
A laboratory course emphasizing fundamental chemical principles and laboratory techniques necessary for an understanding of the chemistry of foods. Relationships between chemical composition and functional, nutritional, and organoleptic properties of foods are stressed. Many of the laboratory techniques involved are common to those used in biochemistry laboratories (e.g., spectrophotometry, chromatography, enzyme assays) but are applied to specific foods or beverages.

FOOD 423 Physical Principles of Food Preservation and Manufacturing
Fall. 3 credits. Prerequisites: FS 321. Lec, T R 11:15–12:05; disc, T 12:20–2:15. S. J. Mulvaney and J. S. Roberts.
This course emphasizes the fundamental principles that underlie much of food preservation and manufacturing. A systems analysis approach is used to make connections between the chemical and physical changes that occur in food processing and their impact on food quality. Topics include materials properties of foods, heat processing, freezing, concentration and drying. Selected products serve as case studies for more complex manufactured foods.

FOOD 424 Food Polymer Science: Principles and Applications
Spring. 3 credits. Prerequisites: introductory chemistry and physics. Lec, T R 10:10–11:00; disc R 11:15–12:05. S. Mulvaney.
Integration of polymer science, food science, and materials science principles as the basis for characterization of the physical properties of food materials. Emphasis is on unique aspects of food materials, e.g. plasticization by water, gelation, lipids, transient networks, and effects of thermal treatments on material properties. Problems and case studies based on proteins, starches, and hydrocolloids relevant to foods.

FOOD 430 Understanding Wine & Beer
Spring. 3 credits. Prerequisites: introductory biology and chemistry or permission of instructor. Students must be 21 years old by the second day of class (Jan. 24, 2002) to enroll. S-U grades optional. T R 1:25–3:20. T. E. Acree, T. Henick-Kling, K. J. Siebert.
An introduction to wine and beer appreciation through the study of fermentation biology, wine and beer composition and sensory perception. Samples of beers and wines are used to illustrate the sensory properties, microbiological processes, and chemical components that determine wine and beer quality. Students learn to recognize the major features of beer and wine that determine sensory quality and know the processes that produced them. Topics include the psychology and chemistry of bouquet, taste, and aroma—the microbiology of fermentation and spoilage—and the sensory properties of wines and beers from different raw materials (produced in various climates with different agricultural practices) and with different wine and beer production techniques.

FOOD 447 International Postharvest Food Systems
Fall. 2 or 3 credits. Prerequisite: freshman chemistry. S-U grades optional. T R 10:10–11:00. M. C. Bourne and staff.
An interdisciplinary course designed for all undergraduate and graduate students. Describes postharvest food losses and methods to reduce the loss. Topics include storage and care of unprocessed and minimally processed foods such as cereal grains, fruits, vegetables, tubers, and fish; biology and control of fungi, insects, and vertebrates in foods; chemical causes of quality loss; effects of climate; and economic and social factors affecting food preservation and storage. Emphasis is given to the problems in developing countries. The third credit requires a written case study of a country or commodity.

FOOD 450 Fundamentals of Food Law
Spring. 2 credits. Offered alternate years. Next offered spring 2002 and 2004; not offered spring 2003. J. M. Regenstein.
Introduction to the complex array of federal and state statutes and regulations that control the processing, packaging, labeling, and distribution of food, including aspects of safety and nutritive value. Emphasis is on the Food and Drug Administration and U.S. Department of Agriculture regulations, but the course also refers to other regulatory agencies. Emphasis is placed on how a food or agricultural professional interacts with this legal system during legislative action, regulatory rule making, and with respect to compliance.

[FOOD 456 Advanced Concepts in Sensory Evaluation
Spring. 2 credits. Prerequisite: FOOD 410. S-U grades optional. Offered alternate years. Not offered spring 2002; next offered spring 2003. F 1:25–3:20. H. T. Lawless.
Readings and discussions of primary source materials in sensory evaluation, including recent advances in sensory methods, historical perspectives, psychophysics, perceptual biases, and multivariate statistical approaches to sensory data. A major independent research project is conducted on a current issue in sensory evaluation.]

FOOD 494 Special Topics in Food Science
Fall or spring. 4 credits maximum. S-U grades optional. Staff.
The department teaches "trial" courses under this number. Offerings vary by semester, and are advertised by the department before the semester starts. Courses offered under the number will be approved by the department curriculum committee, and the same course is not offered more than twice under this number.

FOOD 497 Individual Study in Food Science
Fall or spring. 3 credits maximum. Prerequisite: permission of instructor. Students must register with an Independent Study form (available in 140 Roberts Hall). S-U grades optional. Staff.
May include individual tutorial study, a special topic selected by a professor or a group of students, or selected lectures of a course already offered. Since topics vary, the course may be repeated for credit.

FOOD 498 Undergraduate Teaching Experience
Fall or spring. 3 credits maximum. Prerequisite: permission of instructor. Students must register with an Independent Study Form (available in 140 Roberts Hall). S-U grades only. Staff.
Students assist in teaching a course appropriate to their previous training and experience. Students meet with a discussion or laboratory section and regularly discuss objectives with the course instructor.

FOOD 499 Undergraduate Research in Food Science
Fall or spring. 4 credits maximum. S-U grades optional. Students must register with an Independent Study form (available in 140 Roberts Hall). This course may be repeated for credit. Staff.
Students conduct original research directed by a food science faculty member.

FOOD 599 Research for Lausanne Exchange Students
Fall/spring. 10 credits maximum. Prerequisite: permission of instructor. S-U grades optional. Staff.
Undergraduate senior thesis research for Lausanne exchange students only. Students conduct original research directed by a Food Science faculty member. A final report is written and presented to the faculties of both Cornell University and the University of Lausanne.

FOOD 600 Seminar in Food Science
Fall and spring. 1 credit. S-U grades only. Required of all food science graduate students. T 4:00–5:00. Staff.

A weekly seminar series on contemporary topics and issues in the Field of Food Science and Technology. Representatives from academia, industry, and government provide presentations on a wide variety of topics. Graduate students in the Field of Food Science and Technology may use the forum to present their required thesis research seminar. Required of all graduate students in the Field of Food Science and Technology. Strongly recommended for graduate students minoring in Food Science and Technology.

[FOOD 604 Chemistry of Dairy Products
Fall. 2 credits. Limited to 16 students. Prerequisites: Food Science 210, 417, 418, and a dairy foods processing course. Permission of instructor required, if lacking prerequisites. F 1:25–3:30. Offered alternate years. Not offered fall 2001 or 2003, next offered fall 2002. D. M. Barbano.
The chemical and physical changes that occur in dairy products prior to, during, and after processing are covered. This course emphasizes current research in dairy chemistry.]

[FOOD 605 Physical Chemistry of Food Components
Fall. 3 credits. Prerequisite: an undergraduate course in physical chemistry. M W F 10:10. Offered alternate years. Not offered fall 2001. J. W. Brady.
This course covers the physical properties of food molecules. Emphasis is placed on the molecular basis of structural characteristics; colloidal properties; molecular interactions; foams, gels; and water binding of foods.]

FOOD 607 Advanced Food Microbiology
Spring. 2 credits. Prerequisites: Microbiology (BIOMI 290), Food Microbiology (FOOD 394). M W 11:15. Offered alternate years. Not offered in spring 2003. Next offered spring 2002. M. Wiedmann.
This two-credit course explores advanced topics in Food Microbiology. A major emphasis is placed on critical evaluation of current literature and on microbiological concepts that affect food microbiology. Specific areas that are covered include microbial ecology of foods, rapid detection and typing methods for foodborne pathogens, microbial modeling, pathogenesis of foodborne diseases, and food applications of genetic engineering. Some guest lectures may be arranged to provide an introduction to other advanced food microbiology topics (e.g., risk assessment).

[FOOD 608 Chemometric Methods in Food Science
Fall. 2 credits. Prerequisite: basic statistics and chemistry or permission of instructor. S-U grades optional. W 1:25–3:20. Offered alternate years. Not offered fall 2001 and 2003; next offered in 2002. K. J. Siebert.
Food science applications using multivariate statistical methods (chemometrics) include extracting information from large data sets, modeling molecular and product properties, optimizing analytical methods and processing operations, discerning relationships between product composition and sensory properties, identifying cultivars or species, and detecting adulteration. The techniques covered are also applicable to many other problems in biology and chemistry.]

FOOD 616 Flavors—Analysis and Applications
Spring. 2 credits. S-U grades optional. Lec, F 1:25; disc, F 2:30. Offered alternate years. Next offered spring 2002 and 2004; not offered spring 2003. H. T. Lawless and T. E. Acree.
An advanced course in sensory and instrumental analysis of flavors, flavor chemistry, and flavor applications in foods for food scientists and those in related fields concerned with human food perception and consumption. The course surveys taste, aroma and volatile flavors, and trigeminal stimuli from the perspectives of chemical structures, methods of analysis, uses and interactions in food systems, and consumer acceptance.

FOOD 620 Food Carbohydrates (also NS 620)
Spring. 2 credits. Limited to qualified seniors and graduate students. Prerequisite: BIOBM 330 or equivalent. T R 10:10. Offered alternate years. Next offered spring 2002 and 2004; not offered spring 2003. B. A. Lewis and J. W. Brady.
A consideration of the chemistry of carbohydrates, including sugars, starches, pectins, hemicelluloses, gums, and other complex carbohydrates. Emphasis is on the intrinsic chemistry and functionality in food systems and the changes occurring during food processing and storage.

FOOD 621 Food Lipids
Fall. 2 credits. Letter grade only. Prerequisites: FOOD 417 and a Biochemistry course. Offered alternate years. Next offered fall 2001; not offered fall 2002 or 2004. R. Liu.
An advanced course in food lipids. Describes the physical, chemical, biochemical, and functional properties of lipids. Emphasis is on lipid oxydation, emulsions, functional foods associated with lipids, and modern analytical methodology of lipids.

FOOD 665 Engineering Properties of Foods
Spring. 2 credits. Prerequisite: course in transport processes or unit operations as applied to foods; or permission of instructor. T R 12:20–1:10. Offered alternate years. Next offered spring 2002; not offered spring 2003. S. S. H. Rizvi and S. J. Mulvaney.
Theories and methods of measurement and prediction of rheological, thermal, and mass transport properties of foods and biomaterial systems. Emphasis is on physical-mathematical basis of measurement as well as the prediction processes. Examples of appropriate use of these properties in engineering design and analysis of food processes are also provided.

FOOD 694 Special Topics in Food Science
Fall or spring. 4 credits maximum. S-U grades optional. Staff.
The department teaches "trial" courses under this number. Offerings vary by semester, and are advertised by the department before the semester starts. Courses offered under the number will be approved by the department curriculum committee, and the same course is not offered more than twice under this number.

FOOD 695 Current Readings in Food Science
Fall and spring. 1 credit. Prerequisite: 300- to 400-level course relevant to the chosen topic. S-U grades only. Lec., by arrangement/1 hour per week. Staff.
A seminar series on current topics chosen by participating faculty and students on a rotating basis. Format consists of weekly discussion groups with each participant presenting at least one oral report based on independent reading. Multiple sections focusing on different topics may be taught in any given semester. Topics include (but are not limited to) Food Microbiology and Food Safety; Food Chemistry; Packaging; Food Engineering. This course can be taken multiple times. Graduate students in Food Science are strongly encouraged to enroll in this course. Interested students should contact the designated instructor(s) for each term.

FOOD 698 Graduate Teaching Experience
Fall and spring. 1 to 3 credits. S-U grades only. Staff.
Designed to give graduate students teaching experience through involvement in planning and teaching courses under the supervision of field faculty members. The experience may include leading discussion sections; preparing, assisting in, or teaching lectures and laboratories; and tutoring.

FOOD 800 Masters-Level Thesis Research
Fall or spring. Credit TBA. Maximum credit, 12. Prerequisite: limited to master's candidates; permission of Special Committee Chair. S-U grades only. Graduate faculty.

FOOD 900 Graduate-Level Thesis Research
Fall or spring. Credit TBA. Maximum credit, 12. Prerequisite: limited to doctoral students who have not passed the "A" exam; permission of Special Committee Chair. S-U grades only. Graduate faculty.

FOOD 901 Doctoral-Level Thesis Research
Fall or spring. Credit TBA. Maximum credit, 12. Prerequisite: limited to doctoral students who have passed the "A" exam; permission of Special Committee Chair. S-U grades only. Graduate faculty.

Related Courses in Other Departments

Introduction to Computing (ABEN 151)

Introduction to Business Management (AEM [ARME] 220)

Marketing (AEM [ARME] 240)

Food Industry Management (AEM [ARME] 443)

Biological and Environmental Transport Processes (ABEN 350)

Computer-Aided Engineering: Applications to Biomaterials and Food Processing (ABEN 453)

Practical Aspects of Postharvest Handling of Horticultural Crops (HORT 325)

Introduction to Culinary Arts (H ADM 230)

FREEHAND DRAWING AND SCIENTIFIC ILLUSTRATION

Freehand Drawing is a program in the Department of Horticulture. Other courses offered by the department are listed under Horticulture.

[FR DR 109 Nature Drawing
Fall. 3 credits. Limited to 25 students. S-U grades optional. Permission of instructor required. M W F 10:10–12:05. Not offered 2001–2002. R. J. Lambert.
A beginning course with emphasis on the drawing of natural forms: plants, animals, and landscapes. Of particular interest to students in floriculture and ornamental horticulture, landscape architecture, biological sciences, nature education, or similar fields. Outside field notebook assignments.]

[FR DR 211 Freehand Drawing and Illustration
Fall. 2 credits. Prerequisite: FR DR 109 or equivalent. S-U grades optional. 6 studio hours scheduled in 2 or 3 hour units between 9:05 and 12:05 M T W R. Not offered 2001–2002. R. J. Lambert.
Progression to the organization of complete illustrations. Subject matter largely from sketchbooks, still life, and imagination. Composition, perspective, and ways of rendering in different media are considered.]

FR DR 214 Watercolor
Spring. 2 credits. S-U grades optional. 4 studio hours scheduled in 2 hour units between 9:05 and 12:05 and 2 hours outside sketching. T W R. R. J. Lambert.
A survey of watercolor techniques. Subject matter largely still life, sketchbook, and on-the-spot outdoor painting.

FR DR 316 Advanced Drawing
Fall. 2 credits. Prerequisite: FR DR 109, 211 or permission of instructor. S-U grades optional. 4 hours TBA. T W R 9:05–12:05, 2 hours outside sketching. R. J. Lambert.
For students who want to attain proficiency in a particular type of illustration or technique.

[FR DR 417 Scientific Illustration
Fall. 2 credits. Prerequisite: FR DR 211 or 316 or equivalent. S-U grades optional for graduate students only. Not offered fall 2001. R. J. Lambert.
A survey of methods of illustration. Training in techniques of accurate representation in media suitable for reproduction processes, including pen and ink, scratchboard, wash, and mixed media.]

FRUIT AND VEGETABLE SCIENCE: HORTICULTURAL SCIENCE

See Horticulture.

HORTICULTURE

H. C. Wien, chair; N. L. Bassuk, R. R. Bellinder, L. Cheng, L. E. Drinkwater, L. A. Ellerbrock, G. L. Good, D. E. Halseth, R. J. Lambert, C. P. Mazza, I. A. Merwin, W. B. Miller, K. W. Mudge, A. M. Petrovic, M. P. Pritts, D. A. Rakow, A. Rangarajan, F. S. Rossi, L. D. Topoleski, C. B. Watkins, T. C. Weiler, L. A. Weston, T. H. Whitlow, D. W. Wolfe

Courses by Subject:

General horticulture: 101, 102
Public garden management: 485
Crop production:
Agroforestry: 415
Fruit: 442, 444, 445
Greenhouse and controlled environments: 310, 400
Nursery: 400, 420
Turfgrass: 330, 475
Vegetable: 225, 366, 460
Extension education: 476
Horticultural physiology: 400, 449, 455, 460, 462, 615, 620
Independent study, research, and teaching: 495, 496, 497, 498, 499, 500, 700, 800, 900
Internships: 496
Landscape horticulture: 301, 435, 440, 485, 491, 492
Plant materials: 243, 300, 301, 317, 491, 492
Plant propagation: 317, 400
Postharvest physiology: 325, 625
Seminars: 600
Special topics: 494, 635, 694
Turfgrass management: 330, 475
Vegetable types and varieties: 220, 465

Note: class meeting times are accurate at the time of publication. If changes are necessary, the department will provide new information as soon as possible.

HORT 101 Horticultural Science and Systems
Fall. 4 credits. Lec, M W F 9:05; lab, W 1:25–4:25. I. A. Merwin.
The science and technology of horticultural plants grown for foods and beverages, and ornamental, landscape or recreational purposes. Lectures, labs and field trips involve natural history and evolution of horticultural plants, botany and physiology, sustainable management of soil, water and plant nutrition, breeding and propagation, ecological and landscape functions, and integrated design and management of horticultural plantings and production systems.

[HORT 102 General Horticulture
Spring. 4 credits. Each lab limited to 25 students. Lecs, M W F 10:10; lab M T or W 2–4:25. Not offered 2001–2002. L. D. Topoleski.
The subject matter of this course acquaints the student with the applied and basic science of horticulture. Open to all students who want a general knowledge of the subject or who want to specialize in horticulture but have a limited background in practical experience or training in plant science. Includes flower, fruit, and vegetable growing and gardening techniques.]

[HORT 220 Vegetable Types and Identification
Fall. 2 credits. T 2–4:25. Not offered 2001. L. Topoleski.
The subject matter of this course acquaints students with the vegetable species grown in the Northeast and the pests and disorders encountered in their production. Subjects covered include identification of economically destructive weeds, diseases, and insects of vegetables, identification of vegetable and weed seeds, nutrient deficiencies, vegetable judging, and potato grade defects.]

HORT 225 Vegetable Production
Fall. 4 credits. Lecs, M W F 11:15; lab, W 2–4:25; 4 fieldtrips (September). W 11:15–6:00. L. A. Ellerbrock.
Intended for those interested in the production, processing, and marketing of vegetables. Topics included are techniques, problems, and trends in the culture, harvesting, and storage of the major vegetable crops. Field trips to conventional and organic farms and hands-on experience in growing vegetables in the greenhouse are included.

[HORT 243 Taxonomy of Cultivated Plants (also BIOPL 243)
Fall. 4 credits. Prerequisite: 1 year of introductory biology or written permission of instructor. May not be taken for credit after BIOPL 248. Lec, M W F 10:10–11:00; lab, M or W 2:00–4:25. Offered even years. M. A. Luckow.
A study of ferns and seed plants, their relationships, and their classification into families and genera, emphasizing cultivated plants. Particular emphasis is placed on gaining proficiency in identifying and distinguishing families and in preparing and using analytic keys. Attention is also given to the economic importance of taxa, to the basic taxonomic literature, and to the elements of nomenclature.]

HORT 300 Herbaceous Plant Materials
Fall. 3 credits. Fee for lecture-laboratory manual: $35. Lecs, T R 10:10; lab, T 2–4:25. W. B. Miller.
Identification, use, characteristics, and garden cultural requirements of annual and herbaceous perennial plants, especially those used in northern climates. Practical gardening experiences at selected campus locations. Field trips to nearby specialty nurseries. Garden planting design is not a component of the course.

HORT 301 Plants for Interiors
Spring. 3 credits. Lecs, M W 11:15; lab, M 2–4:25. Offered even years. Next offered 2002. T. C. Weiler.
Study of plants for interiors: identification, design characteristics, and cultural requirements; use of plants as elements of planting design (trees, shrubs, groundcovers, and accent plants including potted flowering plants and cut flowers); the interior landscape industry (organization, bidding, installation, maintenance). Required three-day field trip, estimated cost, $130.

[HORT 310 Production and Marketing of Crops Grown in Controlled Environments
Spring. 4 credits. Letter grade only. Offered odd years; next offered 2003. Lecs, T R 10:10; lab R 2–4:25. 2.5 hours TBA. T. C. Weiler.
Basics of establishing and managing agricultural production in environmentally optimized facilities; technology basics, systems and practices, structures, systems and equipment, materials handling, heating and cooling, lighting, fertilizing and irrigation, environmental stewardship, integrated pest management, business management; world centers of production; production of cut, pot, bedding, vegetable, and fruit crops in controlled environments, emphasizing predictive harvesting through environmental, physical, and chemical management of growth and development. Each student grows one or more crops. Required three-day field trip, estimated cost, $130.]

HORT 317 Seed Science and Technology (also CSS 317)
Fall. 3 credits. Prerequisites: BIOPL 241 or an equivalent course approved by instructor. Letter grade only. Offered alternate years. Lecs, T R 11:40–12:30; lab, R 1:25–4:25 P.M. A. G. Taylor, Geneva Experiment Station.
Study of the principles and practices involved in seed production, conditioning, storage, quality management and stand establishment. Information is applicable to various kinds of agricultural and horticultural seeds. Hands-on laboratory experience.

[HORT 325 Practical Aspects of Postharvest Handling of Horticultural Crops
Spring. 3 credits. Lecs, M W 9:05; lab T 1:25–4:25. Next offered 2003. Staff.
A study of changes that occur in horticultural crops between harvest and consumer. Practices that affect the rate of change and the final effect on quality of the commodity are discussed. Maturity/quality indices, preharvest treatments, and harvesting/handling practices and storage/transportation requirements of selected horticulture crops are covered.]

[HORT 330 Turfgrass Management
Fall. 3 credits. Prerequisite: SCAS 260. Lec, M W 10:10; lab, F 10:10–12:05. Not offered 2001–2002. A. M. Petrovic.
Study of the scientific principles involved in the management of golf courses, athletic fields, parks and industrial grounds, and commercial sod production. Considerations given to principles of establishment, mowing, irrigation, growth and development, species selection, pest management, and nutrition in the management of turfgrass sites.]

HORT 366 The Soil Ecosystem (also CSS 366)
Spring. 3 credits lecture; 1 credit lab. Lab cannot be taken without lecture. Prerequisites: one year of introductory biology. S-U optional. Lecs, T R 10:10–11:25; lab, W 1:25–4:25. J. E. Thies, L. E. Drinkwater.
Activities of the soil biata are crucial for the continued functioning and renewal of soil ecosystems. Through study of the soil as an ecosystem, students gain an understanding of the diversity of soil organisms and the critical roles that microbial activities and interactions have in agricultural production and environmental protection. Through a small research project, students also gain competency in developing research questions and formulating hypotheses, planning appropriate methods for gathering and interpreting data, and summarizing research work.

HORT 400 Principles of Plant Propagation
Fall. 3 credits. Prerequisites: BIOPL 242 and 244 or another course in plant physiology. Lecs, T R 9:05; lab, R 1:25–4:25. K. W. Mudge.
Sexual (seed) propagation and asexual (vegetative) propagation including cuttage, graftage, tissue culture, layering, and specialized vegetative reproductive structures. Physiological, environmental, anatomical principles, and industry applications are stressed in lecture and hands-on skills in laboratories. Examples include both temperate and tropical horticultural, agronomic, and forestry crops.

HORT 401 The How, When and Why of Grafting—A Distance Learning Approach
Spring. 2 credits. Lec: autotutorial (web, cd); lab: greenhouse/autotutorial; discussion: e-mail. One introductory face-to-face meeting TBA. K. W. Mudge.
A ten-week, web/CD-based autotutorial approach to the principles and practices of grafting and budding as applied to plant propagation. Emphasis is on the role of grafting in modern horticultural practice and on student development of hands on grafting skills. Instruction involves web-based asynchronous presentation of lecture materials (web, CD-rom), asynchronous discussion and hands-on, autotutorial greenhouse laboratory exercises in grafting.

HORT 415 Principles and Practices of Agroforestry (also NTRES 415 and CSS 415)
Fall. 3 credits. Prerequisites: senior or graduate standing or permission of instructor. S-U option. Lec, M W F 10:10-11:00. Optional laboratory, HORT 416 (also NTRES 416 and CSS [SCAS] 416). Offered alternate years. E. Fernandes, K. Mudge, L. Buck.
An introduction to modern and traditional agroforestry systems which involves spatial or temporal integration of multipurpose woody plants (trees or shrubs) with annual or perennial crops or with livestock. Interactions between woody and nonwoody components of agroforestry systems are considered, based on above- and below-ground processes. The sustainability of agroforestry systems is critically examined from biophysical, socio-economic and policy perspectives.

HORT 416 Principles and Practices of Agroforesty—Laboratory (also NTRES 416 and CSS 416)
Fall. 1 credit. Optional lab component of HORT 415 (also NTRES and CCS [SCAS]). S-U grades optional. Prerequisites: junior, senior, or graduate standing or permission of instructor; prior or concurrent enrollment in HORT 415. W 1:25-4:25. Offered alternate years. K. Mudge, E. Fernandes, L. Buck.
An integrated set of laboratory and field exercises designed to develop competency in diagnostic and management skills applied to agroforestry practice. Sessions include field trips to local practitioners as well as working demonstration farms and forests, case study design and analysis, use of computer-based sources of information, and practical skills with woody plants including identification, propagation, planting, pruning, and measurement.

HORT 420 Principles of Nursery-Crop Production
Fall. 4 credits. Prerequisite: HORT 400. Lecs, M W F 9:05; lab, M 2–4:25. Field trips. Offered odd years. G. L. Good.
Principles of commercial production of nursery crops to marketable stage, including postharvest handling and storage. Term project required. Field trips are made to commercial nurseries.

[HORT 435 Landscape Management
Fall. 4 credits. Prerequisites: HORT 230 or 335. Lecs, M W F 9:05; lab, M 2:00–4:25. Offered even years. G. L. Good.
A study of the practices involved in the maintenance of woody ornamental plants in the landscape. The major emphasis is on post-planting techniques, including water and fertilization management, weed management, pruning, and general tree care. Labs have a hands-on focus.]

HORT 440 Restoration Ecology
Fall. Weeks 1–10. 3 credits. Prerequisite: upper division or graduate standing. Letter grade only. Lecs, T R 10:10; lab, F 1:25–4:25. Offered odd years; 2001. T. H. Whitlow.
An inquiry based treatment of the principles and methods of ecology, conservation biology, hydrology, soil science and related disciplines applied to the restoration of degraded terrestrial ecosystems. Weekly labs, four weekend field trips, and a semester-long project provide many opportunities for experiential learning. Substantial commitment outside of the classroom is expected.

[HORT 442 Berry Crops: Culture and Management
Fall. 3 credits. Lecs, M W 9:05; lab, M 1:25–4:25. Offered even years. M. P. Pritts.
A study of the evolution, breeding history, and physiology of strawberries, raspberries, blackberries, blueberries, and other minor small fruit crops, and of cultural practices that influence productivity, fruit quality, and pest damage. Marketing and economics are considered, and alternative production practices for both commercial and home gardeners are discussed. Frequent field trips enhance classroom activities.]

HORT 444 Vineyard Management
Fall. 3 credits. Lecs, T R 9:05; lab, R 1:30–4:25. R. M. Pool.
Commercial grape production with an emphasis on the problems of production in cold climates. Students examine site selection, world and regional grape varieties, and the anatomical and physiological basis for vineyard management decision making. Laboratory exercises and field trips offer hands-on experience.

HORT 445 Orchard Management
Spring. 3 credits. S-U grades optional. Lec T R 10:10; lab, T 1:25–4:25. Offered even years. A. Merwin.
The science and technology of deciduous tree-fruit production. Topics include basic tree and fruit physiology, orchard renovation and design systems, nutrition, irrigation and freeze protection practices, tree pruning and training, post-harvest fruit storage, marketing and economic spreadsheet models, monitoring and decision systems for integrated pest management, and efficient use of orchard equipment. Emphasis is on the agroecology of perennial crop systems, with labs providing hands-on experience in orchard management. Previous coursework in horticulture and other plant sciences is suggested, but not a prerequisite.

HORT 449 Green Signals and Triggers—The Plant Hormones (also BIOPL 449)
Fall. 1 credit. Prerequisites: introductory biology course and permission of instructor. S-U grades optional. Offered odd years. Lecs, F 1:25–2:15. P. J. Davies.
A study of the plant hormones and how they regulate plant growth and development. Topics include the discovery, role in growth and development, mode of action and practical uses of the plant hormones auxin, gibberellins, cytokinins, abscisic acid, ethylene, and brassinosteroids.

HORT 455 Mineral Nutrition of Crops and Landscape Plants (also CSS 455)
Spring. 3–5 credits. Prerequisite: CSS 260 and BIOPL 242, or equivalent. Lecs, M W F 9:05; lab, R 1:30–4:00. Offered alternate years; not offered spring 2003. H. C. Wien and staff.
A modular course on principles of plant mineral nutrition and nutrient management. A mandatory module on principles is followed by others on agronomic crops, vegetables, floriculture, and fruit crops. Each module carries one credit; a minimum of three credits must be taken in one semester. By the end of the course, students understand the principles of mineral nutrient function in crop plants, are able to diagnose deficiencies by symptoms and tissue tests, and can devise organic and conventional nutrient management schemes that maximize productivity and mineral nutrient quality.

HORT 460 Plant-Plant Interactions
Spring. 3 credits. Prerequisite: any crop production on plant ecology course or permission of instructor. Lecs, T R 9:05; lab/disc, M 2–4:25. D. W. Wolfe.
Mechanisms by which plants interfere or positively interact in the context of environmental conditions such as light, temperature, and fertility. Competitive and chemical interactions are considered between weeds and crops, among crops in polyculture, and between individuals in monoculture. Most examples are taken from temperate and tropical monoculture and intercropping systems, but implications for natural ecosystems are also considered.

[HORT 462 Vegetable Crop Physiology
Spring. 3 credits. Prerequisites: HORT 225 and BIOPL 242. Lecs, T R 9:05; lab/disc, M 2–4:25. Offered alternate years. Not offered spring 2002. H. C. Wien.
Study of the physiological processes that determine the timing, quantity, and quality of vegetable crop yields. Processes of flower induction, fruit set, fruit growth, and the relations between vegetative and reproductive growth are covered. The course emphasizes practical hands-on greenhouse experiments and small group discussions.]

HORT 475 Golf Course Management
Fall. 2 credits. Prerequisite: HORT 330 or equivalent. Lecs, F 1:25–4:25. Offered odd years. A. M. Petrovic.
Advanced study in the management of golf course operations including selection of root zone materials, fertilization practices, integrated pest management practices, irrigation systems, environmental based decision making, personnel management, and financial operations. Analysis of a central New York golf courses provides the basis for discussion.

[HORT 476 Practical Problem Solving in Horticulture
Fall. 2 credits. Prerequisite: permission of instructor. Lec/disc, W 1:25–4:25. Next offered fall 2002. C. P. Mazza.
Foundation for extension or similar career oriented students. Application of horticultural science principles to practical situations faced primarily by home gardeners. Techniques of synthesizing information from various scientific disciplines and strong emphasis on communications skills. Classes led by staff in several departments. Topics are interdisciplinary, drawing from expertise in horticultural science (landscape and food), entomology, plant pathology, natural resources, and Cornell Plantations.]

HORT 480 Plantations Seminar Series
Fall. 1 credit. S-U grade only. W 7:30 P.M. D. A. Rakow.
A 10-week series of seminars given by prominent speakers on a variety of horticultural, natural sciences, and human cultural themes.

[HORT 485 Public Garden Management
Spring. 3 credits. Prerequisites: HORT 300 or HORT 301; HORT 230 or HORT 335. Lec, T R 10:10-11:00, lab, T R 11:15-12:05. Two-and-a-half-day field trip to visit other botanical gardens and arboreta. Next offered spring 2003. D. A. Rakow.
The course explores the history of public gardens, types of contemporary public gardens, and the operation of botanical gardens and arboreta. Included are separate units on: collections curation, design of collections, management of landscapes and natural areas, educational programming, interpretive programs, research, financial management, and staffing.]

HORT 491 Creating the Urban Eden: Woody Plant Selection, Design, and Landscape Establishment (also LA 491)
Fall. 4 credits. Prerequisites: major in horticulture or landscape architecture or permission of instructor. Limited to 48 students. Preregistration required. Lec, T R 12:20–1:10; Lab, T R 1:25–4:25. N. L. Bassuk and P. J. Trowbridge.
This course focuses on the identification, uses, and establishment of woody plants in urban and garden settings. By understanding the environmental limitations to plant growth, students can critically assess potential planting sites, select appropriate trees, shrubs, vines, and ground covers for a given site, and learn about the principles and practices of site amelioration and plant establishment. Design followed by written specifications and graphic details is produced to implement these practices. A project where students implement what they have learned by creating a new landscape serves to integrate theory, principles, and practices.

HORT 492 Creating the Urban Eden: Woody Plant Selection, Design, and Landscape Establishment (also LA 492)
Spring. 4 credits. Prerequisite: a passing grade in HORT/LA 491. Attendance limited to horticulture and landscape architecture majors or permission of the instructors. Limited to 48. Preregistration required. Lec, T R 12:20–1:10, lab, T R 1:25–4:25. N. L. Bassuk and P. J. Trowbridge.
The second half of this course continues focus on the winter identification, uses and establishment of woody plants in urban and garden settings. Issues of site assessment and soil remediation are emphasized in addition to soil volume calculations, drainage and surface detailing, and planting techniques. Students critically assess potential planting sites, select appropriate trees, shrubs, vines and ground covers for a given site. Design for specific sites followed by written specifications and graphic details are produced to implement these proposals. Students implement in a hands-on manner, site remediation and planting techniques they have learned by creating new landscapes that serve to integrate theory, principles, and practices. Together, HORT/LA 491 and 492 constitute an integrated course. Attendance limited to Horticulture and Landscape Architecture majors or permission of the instructors.

HORT 494 Special Topics in Horticulture
Fall or spring. 4 credits maximum. S-U grades optional.
The department teaches "trial" courses under this number. Offerings may vary by semester, and will be advertised before the semester begins. Courses offered under the number will be approved by the department curriculum committee, and the same course is not offered more than twice under this number.

HORT 495 Undergraduate Seminar—Current Topics in Horticulture
Fall and spring. 1 credit. Undergraduate participation in weekly departmental seminar series. Graduate students should enroll in HORT 600. May be taken four times for one credit per semester. S-U grades only. R 4. L. A. Weston, D. W. Wolfe.

HORT 496 Internship in Horticultural Sciences
Fall or spring. Credit variable. S-U grades optional. Prerequisite: permission of student's adviser **in advance of participation** in internship programs. Students must register with an Independent Study form (available in 140 Roberts Hall) signed by the faculty member who will supervise their study and assign their grade. Hours TBA. Staff.

HORT 497 Independent Study in Horticultural Sciences
Fall or spring. Credit variable. S-U grades optional. Prerequisite: permission of instructor(s). Students must register with an Independent Study form (available in 140 Roberts Hall). Independent study in horticultural sciences under the direction of one or more faculty members. Hours TBA. Staff.

HORT 498 Undergraduate Teaching Experience
Fall or spring. Credit variable. S-U grades optional. Prerequisites: previous enrollment in course to be taught or equivalent, and written permission of the instructor. Students must register with an Independent Study form (available in 140 Roberts Hall). Hours TBA. Staff.
Designed to give qualified undergraduate students teaching experience through actual involvement in planning and teaching horticultural sciences courses under the supervision of departmental faculty members. This experience may include leading discussion sections; preparing, assisting in, or teaching laboratories; and tutoring.

HORT 499 Undergraduate Research
Fall or spring. Credit variable. S-U grades optional. Prerequisite: permission of instructor. Students must register with an Independent Study form (available in 140 Roberts Hall.) Hours TBA. Staff.
Undergraduate research projects in horticultural sciences.

HORT 500 Master of Professional Studies (Agriculture) Project
Fall or spring. 1–6 credits. (6 credits maximum toward M.P.S. [Agriculture] degree). S-U grades optional. Staff.
A comprehensive project emphasizing the application of principles and practices to professional horticultural teaching, extension,

and research programs and situations. Required of Master of Professional Studies (Agriculture) candidates in the respective graduate fields of horticulture.

HORT 600 Seminar in Horticulture
Fall and spring. 1 credit. S-U grades only. R 4:00. D. W. Wolfe and L. A. Weston.
Weekly seminars consist of graduate student research project reports, faculty research topics, as well as guest speakers from other universities and/or industry. Required of graduate students majoring or minoring in horticulture. Undergraduate students register under HORT 495.

HORT 615 Quantitative Methods in Horticultural Research
Spring. Weeks 1–7. 2 credits. Prerequisite: BTRY 601, BTRY 602 or permission of instructor. S-U grades only. W F 2:30–4:25. Offered alternate years. D. W. Wolfe.
Advantages and limitations of conventional experimental designs and analyses of greenhouse and field (including-on-farm) experiments. Use and interpretation of plant growth analysis techniques. Discussions include critical analysis of published data and research in progress.

[HORT 620 Woody Plant Physiology
Spring. 4 credits. BIOPL, BIOBM 331, CHEM 357, or equivalent, or permission of instructor. Letter grade only. Lecs, T R 8:40–9:55. Lab, T 1:25–4:25. Offered odd years; 2003. T. H. Whitlow.
An examination of physiological processes in woody plants emphasizing whole plant integration and how these processes affect plant growth under both natural and cropping systems. Topics include: evolution of the woody plant form, structure and function of the root and shoot, growth periodicity, dormancy, growth analysis, carbon balance and allocation, root symbioses, and physiological responses to biotic and abiotic stress. Faculty from Geneva and Fruit and Vegetable Science collaborate in teaching.]

[HORT 625 Advanced Postharvest Physiology of Horticultural Crops
Spring. 3 credits. Prerequisite: BIOPL 242 and/or HORT 325. Lecs, T R 10:10; disc, to be arranged. Not offered spring 2002.
Physiological and biochemical aspects of growth and maturation, ripening, and senescence of harvested horticultural plant parts. Topics include morphological and compositional changes during ripening and storage life, some physiological disorders, aspects of hormone action and interactions, and a consideration of control.]

[HORT 635 Tools for Thought
Fall. 1 credit. Open to graduate students only. S-U grade only. 1 hour per week, TBA. Not offered 2001–2002. T. H. Whitlow.
A discussion of readings from Kuhn, Waddington, Wilson, Lewontin, and others emphasizing application of the philosophy of science to the real world practices of scientists.]

HORT 636 Current Topics in Horticulture
Fall or spring. 1 credit. S-U grades only. One hour per week, TBA. Staff.
A seminar series on current topics chosen by participating students and faculty, on a rotating basis. Format consists of weekly discussion groups, with each participant presenting at least one oral report based on independent reading and/or experimentation relating to the chosen topic. Interested students should contact the designated instructor(s) for each term.

HORT 694 Special Topics in Horticulture
Fall or spring. 4 credits maximum. S-U grades optional. Hours TBA. Staff.
The department teaches "trial" courses under this number. Offerings vary by semester, and are advertised by the department before the semester starts. Courses offered under the number will be approved by the department curriculum committees, and the same course are not offered more than twice under this number.

HORT 700 Graduate Teaching Experience
Fall or spring. Credit variable. Open only to graduate students. Undergraduates should enroll in HORT 498. S-U grades optional. Prerequisite: permission of instructor. Hours TBA. Staff.
Designed to give graduate students teaching experience through involvement in planning and teaching courses under the supervision of departmental faculty members. The experience may include leading discussion sections; preparing, assisting in, or teaching lectures and laboratories; and tutoring.

HORT 800 Thesis Research, Master of Science
Fall or spring. Credit TBA. S-U grades only.

HORT 900 Thesis Research, Doctor of Philosophy
Fall or spring. Credit TBA. S-U grades only.

INTERNATIONAL AGRICULTURE

Note: class meeting times are accurate at the time of publication. If changes are necessary, the department will provide new information as soon as possible.

INTAG 300 Perspectives in International Agriculture and Rural Development
Fall. 2 credits. F 1:25–3:20. R. W. Everett.
A forum to discuss both contemporary and future world food issues and the need for an integrated, multidisciplinary team approach in helping farmers and rural development planners adjust to the ever-changing food needs of the world.

INTAG 314 Tropical Cropping Systems: Biodiversity, Social, and Environmental Impacts (also CSS [SCAS] 314)
Fall. 3 credits. Prerequisite: an introductory course in crop science, soil science, or biology or permission of instructor. Lec, T R 8:40–9:55. E. C. Fernandes.
Characterization and discussion of traditional shifting cultivation, lowland rice-based systems, upland cereal-based systems, smallholder mixed farming including root crops and livestock, plantation fruit and oil crop systems, and agroforestry. In addition to species diversity and domestication, factors such as climate, land quality, soil management, land tenure, labor, and markets are considered. The effect of tropical cropping systems on the environment is evaluated.

INTAG 402 Agriculture in the Developing Nations I
Fall. 2 credits. Prerequisite: International Agriculture 300. F 1:25–3:20. P. A. Arneson and staff.
The goal of this course is to acquaint students with the major issues and problems in international agriculture and rural development and to show how problems in development are being addressed by international, government, and nongovernment agencies. The lectures/discussions attempt to establish the global context for sustainable agricultural development and focus on agriculture in the tropics, using case studies of agricultural development in Latin America, especially Ecuador. This course may be taken as a stand-alone survey course in international agriculture, but it is also the preparatory course for participation in Agriculture in the Developing Nations II (International Agriculture 602), which includes a trip to Ecuador during the intersession.

INTAG 403 Traditional Agriculture in Developing Countries
Fall. 1 credit. S-U only. T 8–8:50. H. D. Thurston, D. Bates, R. Blake, J. Lassoie, A. Power, E. Fernandez, T. Steenhuis.
Today, perhaps over half of the world's arable land is farmed by traditional farmers. They developed sustainable agriculture practices which allowed them to produce food and fiber for millennia with few outside inputs. Many of these practices have been forgotten in developed countries but are still used by many traditional, subsistence, or partially subsistence farmers in developing countries. The course examines traditional systems from several disciplinary points of view.

INTAG 480 Global Seminar: Environment and Sustainable Food Systems (also ALS 480 and EDUC 480)
Spring. 1–3 credits. Prerequisite: juniors, seniors, and graduate students. Letter grade. Lec, R 8:00–9:55 A.M., Lab, 3:35–4:25 P.M. scheduled, one additional hour unscheduled. H. D. Sutphin, P. A. Arneson, and D. Lee.
For description, see ALS 480.

INTAG 497 Independent Study in INTAG
Fall and spring. 1–3 credits. S-U or letter grade. Prerequisites: permission of instructor and signed Independent Study Form. Staff.
Independent Study in INTAG allows students the opportunity to investigate special interests that are not treated in regularly scheduled courses. The student develops a plan of study to pursue under the direction of a faculty member.

INTAG 598 International Development M.P.S. Project Paper
Fall and spring. 1–6 credits. (A maximum of 6 credits may be applied toward M.P.S. degree requirements). Limited to M.P.S. candidates in the Field of International Development (ID). S-U grades only. N. Uphoff.
A problem-solving project entailing either fieldwork and/or library work. The aim of the project is to give students supervised experience in dealing intellectually and analytically with a professional problem related to a substantive area of international development.

INTAG 599 International Agriculture and Rural Development M.P.S. Project Paper

Fall and spring. 1–6 credits. (A maximum of 6 credits may be applied toward M.P.S. degree requirements). Limited to M.P.S. candidates in the Field of International Agriculture and Rural Development (IARD). S-U grades only. R. Blake.

A problem-solving project entailing either fieldwork and/or library work. The aim of the project is to give students supervised experience in dealing intellectually and analytically with a professional problem related to a substantive area of international agriculture and rural development.

INTAG 602 Agriculture in the Developing Nations II

Spring. 3 credits. Prerequisites: INTAG 300 or equivalent, INTAG 402, and permission of instructors. Cost of field-study trip includes air fare and approximately $450 for lodging, meals, and personal expenses. T R 2:30–4:25 until midterm only. R. W. Blake and staff.

Oriented to provide students an opportunity to observe agricultural development in a tropical environment and promote interdisciplinary exchange among staff and students. The two-week field-study trip during January to Latin American countries is followed by discussions and assignments dealing with problems in agriculture and livestock production in the context of social and economic conditions.

INTAG 603 Administration of Agricultural and Rural Development (also GOVT 692)

Spring. 4 credits. M 2:30–5:30. N. T. Uphoff and T. W. Tucker.

An intercollege course designed to provide graduate students with a multidisciplinary perspective on the administration of agricultural and rural development activities in developing countries. The course is oriented to students in agricultural or social sciences who may have administrative responsibilities during their professional careers.

INTAG 685 Training and Development: Theory and Practice (also COMM 685, EDUC 685 and ILR 658)

Spring and summer. 4 credits. S-U grades optional. M. Kroma.

Analysis, design, and administration of training programs for the development of human resources in small-farm agriculture, rural health and nutrition, literacy as nonformal education, and general community development. Designed for scientists, administrators, educator-trainers, and social organizers in rural and agricultural development programs in the United States and abroad.

INTAG 694 Graduate Special Topics in INTAG

Fall or spring. 1–4 credits. S-U or letter option. Staff.

The department teaches "trial" courses under this number. Offerings vary by semester and are advertised by the department before the semester starts. Courses offered under the number will be approved by the department curriculum committee, and the same course is not offered more than twice under this number.

INTAG 697–698 International Development M.P.S. Seminar

Fall, spring. 1 credit. S-U only. N. Uphoff.

A seminar for M.P.S. students to discuss important issues in international development and to prepare them to write their project papers. Specific content varies.

INTAG 699 International Agriculture and Rural Development M.P.S. Project Seminar

Fall, spring. 1 credit. S-U grade only. Required for, and limited to, M.P.S. IARD students or with permission of instructor. R. Blake.

The seminar provides students with the opportunity to develop and present their special projects. It also serves as a forum for discussion of current issues in low-income agricultural and rural development, with particular attention to interdisciplinary complexities.

INTAG 783 Farmer Centered Research and Extension (also EDUC 783)

Fall. 3 credits. S-U or letter option. M. Kroma and T. Tucker.

This course provides an introduction to participatory traditions in farming systems research, extension, evaluation of rural development, technology generation, gender analysis, participatory rural appraisal, and documentation of local and indigenous knowledge of community-based development. Case studies of farmer-centered research and extension provide a focus for analysis. Appropriate roles of researchers and extensionists as partners with farmers are examined. A major contribution of farmer-centered research and extensions is its potential to legitimize people's knowledge by enhancing their capacity to critically analyze their own problems, to conduct their own research, and to empower them to take direct action to solve those problems.

Related Courses in Other Departments

Related Courses in Other Departments

In addition to International Agriculture (INTAG) courses, there are a wide variety of other courses with an international focus. The following are suggested relevant courses:

Agricultural & Biological Engineering

How to Manage a Watershed (ABEN/GOVT 644)

Applied Economics & Management

International Trade and Monetary Economics (AEM 230)

*Global Agribusiness Management (AEM 329)

International Trade Policy (AEM 430)

*Food Marketing Colloquium (AEM 446/447)

Global Marketing Strategy (AEM 449)

Seminar on Agricultural Trade Policy (AEM 730)

Macro Policy in Developing Countries (AEM 763)

Agriculture & Life Sciences

*Agriculture Study Tour to Burgundy, France (ALS 402)

*Internship Opportunities in Burgundy, France (ALS 403)

Global Seminar (ALS 480)

Animal Science

Tropical Livestock Production (AN SC 400)

Tropical Forages (AN SC 403)

Asian Studies

Southeast Asia Seminar: Country Seminar (ASIAN 601)

Biology

Biology of the Neotropics (BIOEE 405)

Food, Agriculture, and Society (BIOEE 469)

The Healing Forest (BIO PL 348)

Communication

Communication in the Developing Nations (COMM 424)

Intercultural and Development Communication (COMM 612)

City & Regional Planning

Seminar in International Planning (CRP 671)

Seminar in Project Planning in Developing Countries (CRP 675)

Crop & Soil Science

Properties and Appraisal of Soils of the Tropics (CSS 471)

Ecology of Agricultural Systems (CSS 473)

Tropical Cropping Systems (CSS/INTAG 314)

Education

Comparative Studies in Adult Education (EDUC 483)

Farmer-Centered Research & Extension (EDUC/INTAG 783)

Food Science

International Postharvest Food Systems (FOOD 447)

Horticulture

Genetic Improvement of Crop Plants (HORT 403)

Nutritional Science

Nutritional Problems in Developing Nations (NS 306)

Integrating Food Systems and Human Needs (NS 380)

National and International Food Economics (NS 457)

International Nutrition Problems, Policy, and Programs (NS 680)

Natural Resources

Ecological Dimensions of Global Change (NTRES 350)

International Environmental Issues (NTRES 400)

Religion, Ethics, and the Environment (NTRES 407)

Principles and Practices of Agroforestry (NTRES/HORT 415)

Plant Breeding

Introduction to Plant Breeding (PL BR 201)

Genetic Diversity (PL BR 404)

Plant Pathology

Plant Diseases in Tropical Agriculture (PL PA 655)

Integrated Pest Management in Tropical Agriculture (PL PA 655)

Rural Sociology

Population Dynamics (RSOC 201)

International Development (RSOC 205)

Social Indicators, Data Management and Analysis (RSOC 213)

Comparative Issues in Social Stratification (RSOC 370)

Human Fertility in Developing Nations (RSOC 408)

Population and Environment (RSOC 410)

Population Policy (RSOC 418)

Migration and Population Redistribution (RSOC 430)

Social Impact of Resource Development (RSOC 440)

Society and Survival (RSOC 490)

Population, Environment, and Development in Sub-Saharan Africa (RSOC 495)

Sociological Theories of Development (RSOC 606)

The Sociology of "Third World" States (RSOC 725)

*Includes overseas travel

LANDSCAPE ARCHITECTURE

M. I. Adleman, S. Baugher, K. L. Gleason, H. W. Gottfried, P. H. Horrigan, R. Jaenson, D. W. Krall, L. J. Mirin, R. T. Trancik, P. J. Trowbridge, K. A. Wolf

LA 141 Grounding in Landscape Architecture
Fall. 4 credits. Limited to 15 students. Letter grade only. Cost of basic drafting equipment for the major plus materials for projects; about $250.
Introduction to the representation and design of landscapes and to working in a studio setting. Freehand drawing, measured drawing, and model making are used to understand design principles of the changing landscape.

LA 142 Grounding in Landscape Architecture
Spring. 4 credits. Limited to approximately 20 students; freshman landscape architecture majors or permission of instructor. Cost of basic drafting equipment and project supplies, about $250.
Fundamentals of landscape design applied to small-scale site-planning projects. Work in the studio introduces course participant to the design process, design principles, construction materials, planting design, and graphics.

LA 201 Medium of the Landscape
Fall. 5 credits. Limited to landscape architecture majors. Cost of basic drafting equipment, supplies, and fees, about $200; expenses for field trip, about $250.
This studio course emphasizes the design process and principles involved in organizing and giving form to outdoor space through the use of structures, vehicular and pedestrian circulation systems, earthform, water, and vegetation.

LA 202 Medium of the Landscape
Spring. 5 credits. Prerequisite: LA 201 with a grade of C or better. Cost of supplies and fees, about $250; expenses for field trip, about $250.
This course focuses on the role of materials in design, design theory, and design vocabulary associated with landscape architectural projects.

[LA 260 Pre-Industrial Cities and Towns of North America (also CRP 260 and CRP 666 and LA 666)
Fall. 3 credits. Offered alternate years. Next offered fall 2002.
Various American Indian civilizations as well as diverse European cultures have all exerted their influences on the organization of town and city living. The course considers how each culture has altered the landscape in its own unique way as it created its own built environments.]

LA 261 Urban Archaeology (also CRP 261)
Fall. 3 credits.
Urban archaeologists study American Indian, colonial, and nineteenth-century sites which now lie within the boundaries of modern cities. This course explores how urban centers evolve; what lies beneath today's cities; and how various cultures have altered the urban landscape. Students participate in a local archaeological excavation.

LA 262 Laboratory in Landscape Archaeology (also ARKEO 262)
Fall. 3 credits. Prerequisites: LA 261 or CRP 261 or permission of instructor.
Various American Indian civilizations and European cultures have all altered the landscape to meet the needs of their cultures. Students learn how to interpret the American Indian and Euro-American landscapes of specific archaeological sites by identifying and dating artifacts, studying soil samples, and creating site maps.

LA 263/547 American Indians, Planners, and Public Policy (also CRP 363/547)
Spring. 3 credits. Offered in alternate years.
Decisions made by public agencies and private enterprise too often lead to the flooding, polluting, strip-mining, or other destruction of American Indian reservations, archaeological sites, and burial grounds. The central focus of this course is how to address urban and regional problems without imperiling the cultural survival of minorities.

LA 282 The American Landscape
Fall. 3 credits.
An interdisciplinary study of the environmental and cultural history of the American landscape. Topics include the relation of landscape to culture, landscape use and ecological change, regional and national landscapes, and perceptions of landscape expressed in paintings, photographs, and literature.

LA 292 Creating a Second Nature
Spring. 3 credits. Prerequisites: none, but ARKEO 100, ANTHR 100, or CLASSICS/HISTORY OF ART 220 recommended. Offered alternate years.
What can archaeological investigation tell us about the landscape of cultures that spent much of their civic and private lives out of doors? This course introduces the evidence for the markets, parks, gardens, fields, and burial places central to daily life in the ancient Near East and Classical Worlds and formative of our current ideas of these landscapes.

LA 301 Integrating Theory and Practice I
Fall. 5 credits. Prerequisite: LA 202 with a grade of C or better. Cost of supplies and fees, about $250; expenses for field trip, about $250.
Course participants are engaged in the art and science of site-scaled design. This includes relating construction and planting details to concepts and program.

LA 302 Urban Design in Virtual Space
Spring. 5 credits. Cost of supplies and fees, about $250; basic expenses for field trip, about $250.
A sequence of projects introducing students to advanced skills in large-scale urban design, including 3-D computer modeling and digital design media as tools for shaping the form of the city.

LA 315 Site Engineering I
Spring. 3 credits. Prerequisite: permission of instructor.
Lectures and studio projects focusing on the professional skills and knowledge required to competently and creatively develop grading plans for project-scale site design.

LA 316 Site Engineering II
Fall. 2 credits. Prerequisite: LA 315 or permission of instructor.
Lectures and studio projects dealing with earthwork estimating; storm water management, site surveys, site layout, and horizontal and vertical road alignment.

LA 318 Site Construction
Spring. 5 credits. Prerequisite: permission of instructor.
The emphasis of this course is detail design and use of landscape materials in project implementation. Exploration of construction materials, including specifications, cost estimates, and methods used by landscape architects in project implementation are the foci for this course. The course includes lectures, studio problems, and development of drawings leading to construction documentation for a comprehensive project. Students develop a process of self criticism related to measured drawings specific to the comprehensive project. Course participants fabricate material prototypes in wood and metal.

LA 402 Integrating Theory and Practice: Community Design Studio
Spring. 5 credits. Prerequisite: LA 301 with a grade of C or better. Cost of supplies and fees, about $250; expenses for field trip, about $250.
This course engages the theory and practice of participatory community design through a real community service project. Students become knowledgeable about the theory and practice of community design while learning an array of techniques and tools. Participants gain an understanding of how to integrate meaningful public service with design invention and creativity, engage rigorous design research methods, and understand how institutional and community contexts influence design problem-solving. Students will be expected to work independently and collaboratively on team projects in a community. One class period per week will be designated for community fieldwork. Studio theme for 2001–2002 to be announced.

LA 403 Directed Study: The Concentration
Fall, spring. 1 credit. Prerequisite: any Landscape Architecture undergraduate students in their final year of study.

Working with their adviser, students create a written and visual paper that documents the concentration intent.

LA 410 Computer Applications in Landscape Architecture
Fall or spring. 3 credits. Offered to landscape architecture students only. Limited to 15 students.
This course is designed to develop a working knowledge of various computer software applications with emphasis on Autocad. The course explores other applications relative to land-use planning and the profession of Landscape Architecture.

LA 412 Professional Practice
Spring. 1 credit.
Presents the student with a comprehensive understanding of the role of the professional landscape architect and the problems and opportunities one may encounter in an office or in other professional situations. Topics discussed include practice diversity, marketing professional services, office and project management, construction management, computers in the profession, and ethics.

LA 486 Placemaking by Design
Spring. 3 credits. Permission of instructor. S-U grades optional.
This seminar provides an understanding of contemporary planning and landscape architectural design strategies that reaffirm and reclaim a sense of place. Readings and discussions focus on the theory and practice of placemaking as represented in the literature and in built works. The seminar addresses the following questions: What constitutes a place-based design approach and what distinguishes it from other more conventional design approaches? Who are the key players shaping the theory and practice of placemaking?

LA 490 Rome Wasn't Built in a Day
Spring. 3 credits.
In this electronic course, students learn about how the form and spatial structure of the city of Rome has evolved through time. Using the interactive CD-ROM *Layers of Rome* as a digital text, the course engages participants in the investigations of urban design in Rome both as a case study and as a vehicle for exploring concepts applicable to many contemporary cities worldwide. The material focuses on the intersection between historical studies of urban space, architectural geography, urban landscape formation, and the design of cities. Lectures, research, readings and exercises are developed using the *Layers of Rome* CD, web searches, digital networking, and various interactive learning technologies geared toward urban analysis and visual design media.

LA 491 Creating the Urban Eden: Woody Plant Selection, Design and Landscape Establishment (also HORT 491)
Fall. 4 credits. Prerequisites: major in horticulture or landscape architecture or permission of instructor. Cost of supplies, about $50; expenses for field trips, about $50.
This course focuses on the identification, uses, and establishment of woody plants in urban and garden settings. By understanding the environmental limitations to plant growth, students are able to critically assess potential planting sites, select appropriate trees, shrubs, vines, and ground covers for a given site, and learn about the principles and practices of site amelioration and plant establishment. Design followed by written specifications and graphic details is produced to implement these practices.

LA 492 Creating the Urban Eden: Woody Plant Selection, Design, and Landscape Establishment (also HORT 492)
Spring. 4 credits. Prerequisites: a passing grade in HORT/LA 491. Attendance limited to horticulture and landscape architecture majors or permission of the instructors. Limited to 48. Preregistration required.
The second half of this course continues to focus on the winter identification, uses and establishment of woody plants in urban and garden settings. Issues of site assessment and soil remediation are emphasized in addition to soil volume calculations, drainage and surface detailing and planting techniques. Students critically assess potential planting sites, select appropriate trees, shrubs, vines and ground covers for a given site. Design for specific sites followed by written specifications and graphic details are produced to implement these proposals. Students implement in a hands-on manner, site remediation and planting techniques they have learned by creating new landscapes that serve to integrate theory, principles and practices. Together, HORT/LA 491 and 492 constitute an integrated course.

LA 494 Special Topics in Landscape Architecture
Fall or spring. 1–3 credits; may be repeated for credit. S-U grades optional.
Topical subjects in landscape architectural design, theory, history, or technology. Group study of topics not considered in other courses.

LA 495 Green Cities: The Future of Urban Ecology (also CRP 495)
Fall. 4 credits.
Explores the history and future of the ecology of cities and their role in solving the present global ecological crisis. The politics, design, and economics of "green cities" are examined in terms of transportation, renewable energy, solid waste and recycling, land use, and the built environment.

LA 497 Individual Study in Landscape Architecture
Fall or spring. 1–5 credits; may be repeated for credit. Students must register with an Independent Study form (available in 140 Roberts Hall). S-U grades optional.
Work on special topics by individuals or small groups.

LA 498 Undergraduate Teaching
Fall or spring. 1–2 credits. Prerequisites: previous enrollment in course to be taught and permission of instructor. Students must register with an Independent Study form (available in 140 Roberts Hall).
Designed to give qualified undergraduates experience through actual involvement in planning and teaching courses under the supervision of department faculty.

LA 501 Composition and Theory
Fall. 5 credits. Limited to graduate students. Cost of drafting supplies and fees, about $250. Field trip about $250.
Basic principles of natural and cultural processes that form "places" in the landscape. Projects focus on design applied to the practice of landscape architecture: particularly the relationship between measurement, process, experience, and form at multiple scales of intervention.

LA 502 Composition and Theory
Spring. 5 credits. Limited to graduate students. Cost of drafting supplies and fees, about $250; expenses for field trip, about $250.
The studio focuses on the spatial design of project-scale site development. Students develop their expertise in applying the design theory, vocabulary, and graphic expression introduced in LA 501.

LA 505 Landscape Representation I
Fall. 3 credits. Prerequisites: concurrent enrollment in LA 501 or permission of instructor.
This course introduces students to both conventional and unconventional modes of landscape architectural design representation. Drafting, orthographic drawing, axonometric project, lettering, analysis and concept drawing are taught alongside more expressive modes of direct site study and representation.

LA 506 Graphic Communication II
Spring. 3 credits. Prerequisites: LA 505 and concurrent enrollment in LA 502 or permission of instructor.
An intermediate level course focused on modes of landscape representation from ideation to presentation. Representation modes may include freehand, process drawing, analysis and orthographic drawing; concept modelling; composite drawings; and visual books.

LANAR 524 History of European Landscape Architecture*
Fall. 3 credits.
*Offered through the College of Architecture, Art, and Planning.

LANAR 525 History of American Landscape Architecture*
Spring. 3 credits.
*Offered through the College of Architecture, Art, and Planning.

LA 545 The Parks and Fora of Imperial Rome
Spring. 3 credits. Prerequisites: advanced standing in a design field, classics or history of art, other disciplines, or by permission of the instructor.
This advanced seminar is seeking an interdisciplinary group of students in classics, art history, archaeology, landscape architecture, horticulture, and architecture to bring their knowledge of Latin, Greek, Italian, archaeology, drawing, design, or computer modeling to a collaborative study of the ancient fora and public parks depicted on the Severan Marble plan of Rome. Opportunity for a spring break trip to Rome.

LA 569 Archaeology in Preservation Planning and Site Design (also CRP 569)
Spring. 3 credits. Offered alternate years.
In response to federal, state, and local legislation, archaeology now plays an important role in design, planning, and land-use decisions. Students develop the research skills needed to complete environmental review projects and historic landscape plans.

LA 580 Landscape Preservation: Theory and Practice
Fall. 3 credits. Prerequisites: Limited to junior and senior undergrads, and graduate students.

This course examines the evolving practice of landscape preservation in the United States. Topics include the recent history of the discipline, methodology in documentation of historic landscapes, and important practitioners and notable projects. Format for the class is assigned readings and discussion, invited speakers, lectures, and a project documenting a local site.

LA 582 The American Landscape
Fall. 3 credits.
An interdisciplinary study of the environmental and cultural history of the American landscape. Topics include the relation of landscape to culture, landscape use and ecological change, regional and national landscapes, and perceptions of landscape expressed in paintings, photographs, and literature. Graduate students complete additional outside work and attend an additional class session.

LA 590 Theory Seminar
Spring. 3 credits.
Seminar in landscape design theory. For graduate students and seniors.

LA 598 Graduate Teaching
Fall or spring. 1–3 credits. Prerequisite: permission of instructor. Students must register with an Independent Study form. Staff.
Designed to give qualified students experience through involvement in planning and teaching courses under the supervision of faculty members. The experience may include leading discussion sections, preparing, assisting in desk critiques, and presenting lectures. There are assigned readings and discussion sessions on education theory and practice throughout the term. (Credit hours are determined by: 2 hours per week = 1 credit hour).

LA 601 Integrating Theory and Practice I
Fall. 5 credits. Limited to graduate students. Cost of supplies and fees, about $250.
The studio focuses on site-scaled projects that consider significant cultural and natural landscapes. Theories of landscape restoration, sustainable design, and landscape representation are explored through projects that derive form from site and place. The integration of site history and ecology and site construction supports an understanding and relationship between design and site.

LA 602 Integrating Theory and Practice II
Spring. 5 credits. Limited to graduate students. Cost of drafting supplies and fees, about $250; expenses for field trip, about $250.
The studio builds upon prior course work with an expectation that participants can creatively manipulate the program and conditions of a site, with increased emphasis on contemporary construction technology. The course focuses on the expression of design solutions that grow from and affirm an explicit sense of site and place. Social, cultural, physical, and historic factors and their relationship to site design and planning are critically explored through theory and practice.

LA 603 Directed Study: The Concentration
Fall, spring. 1 credit. Prerequisite: any Landscape Architecture graduate student in their final year of study.
Working with their adviser, students create a written and visual paper that documents the concentration intent.

LA 615 Site Engineering I
Spring. 3 credits. Prerequisite: permission of instructor.
Lectures and studio projects focusing on the professional skills and knowledge required to competently and creatively develop grading plans for project-scale site design.

LA 616 Site Engineering II
Fall. 2 credits. Prerequisite: LA 615 or permission of instructor.
Lectures and studio projects dealing with earthwork estimating, storm water management, site surveys, site layout, and horizontal and vertical road alignment.

LA 618 Site Construction
Spring. 5 credits. Prerequisite: permission of instructor.
The emphasis of this course is detail design and use of landscape materials in project implementation. Exploration of materials, including specifications, cost estimates, and methods used by landscape architects in project implementation are the foci for this course. The course includes lectures, short studio problems, and the development of drawings leading to construction documentation for a comprehensive project. Students develop a process of self-criticism related to measured drawings specific to the comprehensive project. Course participants fabricate material prototypes in wood and metal.

[LA 619 Advanced Site Grading
Fall. 2 credits. Limited to 10 students. Prerequisite: LA 315 or LA 615. Not offered 2001.
Grading skills and knowledge applied as a design component of site planning projects.]

LA 666 Pre-Industrial Cities and Towns of North America (also CRP 666)
Fall. 3 credits. Offered alternate years.
Various American Indian civilizations as well as diverse European cultures have all exerted their influences on the organization of town and city living. This course considers how each culture altered the landscape in their own way as they created their own built environments.

LA 680 Graduate Seminar in Landscape Architecture
Fall or spring. 1–3 credits. May be repeated for credit. Limited to graduate students. S-U grades optional.
Topical subjects in landscape architectural design, theory, history, or technology. Includes seminar topics and group study not considered in other courses.

LA 694 Special Topics in Landscape Architecture
Fall or spring. 1–3 credits; may be repeated for credit. S-U grades optional.
Topical subjects in landscape architectural design, theory, history, or technology. Includes group study of topics not considered in other courses.

LA 701 Urban Design and Planning: Designing Cities in the Electronic Age (also CRP 555)
Fall. 5 credits. Limited to graduate students. Cost of supplies and fees, about $250; expenses for field trip, about $250.
Application of urban-design and town-planning techniques to specific contemporary problems of city environments. Issues of urbanism are investigated and applied to physical design interventions and spatial typologies involving the street, square, block, garden, and park systems. 3-D computer modeling and digital design media are introduced as tools for urban design. This is a specially arranged collaborative studio with the Department of City and Regional Planning.

LA 702 Advanced Design Studio
Spring. 5 credits.
A capstone studio that provides the opportunity to explore issues in contemporary landscape architecture and to integrate related fields. Topics include the influences of culture, history, and criticism, as well as reinterpretations of engineering and representation.

LA 800 Master's Thesis in Landscape Architecture
Fall or spring. 9 credits.
Independent research, under faculty guidance leading to the development of a comprehensive and defensible design or study related to the field of landscape architecture. Work is expected to be completed in final semester of residency.

NATURAL RESOURCES

J. P. Lassoie, chair; R. A. Baer, M. B. Bain, B. L. Bedford, B. Blossey, T. Brown, L. E. Buck, E. Cooch, P. Curtis, D. J. Decker, J. Enck, T. J. Fahey, T. A. Gavin, J. W. Gillett, J. R. Jackson, B. A. Knuth, C. Kraft, M. E. Krasny, B. Lauber, R. A. Malecki, R. J. McNeil, E. Mills, S. Morreale, M. E. Richmond, L. Rudstam, R. Schneider, R. Sherman, P. J. Smallidge, C. R. Smith, P. Sullivan, J. B. Yavitt

Note: class meeting times are accurate at the time of publication. If changes are necessary, the department will provide new information as soon as possible.

NTRES 100 Principles of Conservation
Fall. 3 credits. Limited to first-year students specializing in natural resources. Letter grade only. M W F 9:05; 1 hr disc TBA. Staff.
The nature of natural resources, how they are managed, and their interactions with individuals and societies are considered. Case histories are used to illustrate both principles and practices. Emphasis is on management of renewable resources based on ecological and cultural perspectives.

NTRES 110 Introduction to the Field of Natural Resources
Fall. 3 credits. Limited to Natural Resource majors only. M W 9:05–9:55; lab, R 2:30–4:25. Letter grade only. R. Sherman and J. Lassoie.
This course provides a comprehensive overview of the modern field of natural resources and environment to new students. The course focuses on identifying the components of knowledge required to understand the Earth's natural resources and ecological systems, and to participate

intelligently in their conservation and management. Local case studies are used to introduce students to the scientific, ethical, and societal basis for protection and management of natural resources and environments. Students become actively engaged in data collection and analysis, use quantitative models to analyze and interpret data, explore the human dimensions of natural resource issues, and come to understand the complexities of the policy process and management strategies.

NTRES 201 Environmental Conservation
Spring. 3 credits. M W F 12:20; 1 hr disc sec TBA. T. Fahey.
At the beginning of the twenty-first century, our lives are increasingly touched by questions about environmental degradation at local, regional, and global scales. Business as usual is being challenged. This course stimulates students to go beyond the often simplistic portraits of the environmental dilemma offered by the mass media to gain a firmer basis for responsible citizenship and action on environmental issues.

NTRES 210 Introductory Field Biology
Fall. 4 credits. Limited to 90 students. Open to sophomores and juniors with an adviser in Natural Resources or by permission of instructor. Prerequisites: BIO G 101 and 102 or equivalent. 2 overnight weekend field trips required. Cost of field trips, approximately $12. Lec, W 9:05; labs, M W 1:25–4:25 or T R 1:25–4:25. T. Gavin and C. Smith.
Introduction to methods of inventorying, identifying, and studying plants and animals. Students are required to learn the taxonomy, natural history, and how to identify approximately 170 species of vertebrates and 80 species of woody plants. Selected aspects of current ecological thinking are stressed. The interaction of students with biological events in the field and accurate recording of those events are emphasized.

NTRES 212 People, Values, and Natural Resources
Spring. 3 credits. M W F 10:10–11:00. J. Tantillo.
Cultural and political context for natural resources conservation and management in North America. Historical basis is explored through analysis of North American environmental history, examining shifts in attitudes and conceptions of human relationships to natural resources and the environment. Key laws guiding policy, conservation, and management of natural resources are reviewed. Concepts underlying the study of human attitudes, behaviors, institutions, and decision-making processes related to natural resource conservation and management are introduced.

NTRES 301 Forest Ecology
Fall. 3 credits. Prerequisite: introductory biology. M W F 11:15. T. J. Fahey.
A comprehensive analysis of the distribution, structure, and dynamics of forest ecosystems. Topics include paleoecology of forests, ecophysiology of forest trees, disturbance, succession and community analysis, primary productivity, and nutrient cycling.

NTRES 302 Forest Ecology Laboratory
Fall. 1 credit. Cost of weekend trip approximately $30. Concurrent enrollment in NTRES 301 required. M 1:25–4:25. T. J. Fahey.
Field trips designed to familiarize students with the nature of regional forests and to provide experience with approaches to quantifying forest composition and its relation to environmental factors. Optional weekend field trips to Adirondacks and to the White Mountains, New Hampshire. Includes group research projects in local forests.

NTRES 303 Forest Management and Maple Syrup Production
Spring. 3 credits. Letter grades only. Lec, T R 10:10–11:00; lab R 12:20–4:25. Offered alternate years. Next offered spring 2002. T. J. Fahey.
A practical, field-oriented course emphasizing principles and practices of multiple purpose management of small, nonindustrial, private forest land in the northeastern United States, including the production of maple syrup.

NTRES 305 Applied Population Ecology
Fall. 3 credits. Letter grade only. Prerequisite: NTRES 210 and background in biology or ecology is strongly recommended; completion or concurrent enrollment in CALS math requirement. M W F 9:05–9:55. E. Cooch.
An in-depth analysis of the ecological factors influencing the natural fluctuation and regulation of animal population numbers. The course examines in detail models of single species and multi-species population dynamics, with emphasis on understanding the relationship between ecological processes operating at the individual level and subsequent dynamics at the population level. Computer and field-based exercises are used to reinforce concepts presented in lecture.

NTRES 306 Coastal and Oceanic Law and Policy
Summer. 2 credits. A special 1-week course offered at Cornell's Shoals Marine Laboratory (SML), on an island off Portmouth, N.H. For more details and an application, consult the SML office, G14 Stimson Hall. Staff.
Intended for students interested in careers in management of marine or coastal resources or in the natural sciences. Subjects include law and policy related to ocean dumping, marine sanctuaries, environmental impact statements, water and air pollution, fisheries management, offshore gas and oil production, and territorial jurisdiction. Lectures on the status and history of law are accompanied by discussion of relevant policy and efficacy of various legal techniques. A case study that requires extensive use of the laboratory's library and personnel is assigned. The week concludes with a mock hearing.

NTRES 308 Natural Resources Management
Fall. 3 credits. Prerequisite: junior standing. M W F 10:10. B. A. Knuth.
Focus is on terrestrial and aquatic resources. Concepts emphasized include the comprehensive planning process and human dimensions of resource management. Students integrate biological, social, and institutional dimensions of management through case studies. Grades are based on individual and group performance.

NTRES 309 Sovereign Tribal Environments
Summer. 1 credit. Prerequisite: none; recommended: one course each in Natural Resources and American Indian Program. Consult Cornell University Summer Session Catalog or the Summer Session and Continuing Education section of this book for scheduling information. S. M. Penningroth.
Under federal law, Native American tribes possess significant attributes of sovereignty. This course introduces American Indian territories as a unique policy arena where tribal jurisdiction and traditions merge with the goals of economic development and cultural survival to shape resource management decisions. Course includes lectures, class discussions, case studies, and a mandatory field trip to an Iroquois territory.

NTRES 321 Introduction to Biogeochemistry (also SES 321)
Fall. 4 credits. Prerequisites: college-level chemistry, plus a course in biology and/or geology. Lec, T R 12:20–1:10; lab, T or R 2:30–4:25. J. B. Yavitt and L. A. Derry.
Control and function of the Earth's global biogeochemical cycles. The course begins with a review of the basic inorganic and organic chemistry of biologically significant elements, and then considers the biogeochemical cycling of carbon, nutrients, and metals that take place in soil, sediments, rivers, and the oceans. Topics include weathering, acid-base chemistry, biological redox processes, nutrient cycling, trace gas fluxes, bio-active metals, the use of isotopic tracers, and mathematical models. Interactions between global biogeochemical cycles and other components of the Earth system are discussed.

NTRES 340 Quantitative Population Analysis
Spring. 3 credits. Prerequisites: college-level course in statistics or mathematics recommended. M W F 9:05–9:55. P. J. Sullivan.
The dynamics and demographics of aquatic and terrestrial populations are examined using statistical techniques and computer modeling. The course emphasizes: estimation of population abundance using statistical surveys, and other sampling techniques; and characterization of population dynamics through mathematical and statistical models representing the fundamental processes of birth, death, growth, and movement. Topics include applications to aquatic and terrestrial organisms of resource and conservation interest.

NTRES 350 Global Ecology and Management
Spring. 3 credits. Prerequisites: college-level courses in biology and chemistry. M W F 12:20–1:10, disc sec, M or W 1:25–2:15. J. B. Yavitt.
Human accelerated environmental changes threaten the integrity of nature. This course explains the ecological principles that comprise this threat. Topics include increasing air temperature, atmospheric carbon dioxide and other gases, and pollution. Discussions explore the likely future behavior of nature given different global change scenarios.

NTRES 370 Conservation of Birds
Spring or summer. 2 credits. Prerequisite: NTRES 210 or permission of instructor. Offered alternate years. Next offered spring 2002. C. R. Smith.
A course for majors and nonmajors, focusing on science-based bird conservation and management at the organism, population, community, and landscape levels. Current resource management issues relevant to birds are explored in the contexts of agricultural

practices, habitat management, tropical deforestation, the design and management of natural preserves, endangered species management, global climate change, and the economic importance of bird study as an outdoor recreational activity.

NTRES 371 Conservation of Birds Laboratory

Spring or summer. 1 credit. Concurrent enrollment in NTRES 270 required. Offered alternate years. Next offered spring 2002. C. R. Smith.

A field-oriented course designed to teach skills of bird observation and identification based on the integration of field marks, songs and calls, and habitat cues. Topics covered include the choice and effective use of field guides, binoculars, and other tools for bird identification; procedures for taking and organizing field notes; the relationships of birds to their habitats and to other birds; and methods and procedures for censusing and surveying songbird populations.

NTRES 400 International Environmental Issues

Fall. 4 credits. Prerequisite: junior standing or above. T R 10:10–12:05. R. McNeil.

A survey of current international environmental issues and the institutions through which we deal with them. Among subjects included are: biodiversity and endangered species, global climate change, Antarctica, Law of the Sea, parks and protected areas, and tourism. International organizations, such as World Bank, World Trade Organization, nongovernment environmental organizations, governments and their policies are studied. Laws and treaties are examined, as are negative forces such as corruption and colonialism. Lectures, discussion, term paper.

NTRES 402 Natural Resources Policy, Planning, and Politics

Spring. 3 credits. Prerequisites: junior standing; special application process, and course fee (approx. $375). Lec, January two-week intersession; two 2-hour orientation sessions in fall semester and four 2-hour sessions in February and March. Completed applications due by October 12. Applications are available by contacting map10@cornell.edu or at www.dnr.cornell.edu/courses/course.html. B. A. Knuth.

An introduction to the environmental policy process and its conceptual framework. Recognizing and defining natural resource or environmental problems and issues; aggregating interests; formulating and selecting alternative solutions; implementation and evaluation stages; roles of lobbyists, legislature, executive branch, and other actors. Case studies; presentations by and discussions with about twenty prominent Washington policy makers appearing as guest lecturers. Required interviews, term paper, and oral reports. Several meetings in Ithaca before and after intensive January session in Washington.

NTRES 406 Ecology Risk Assessment (also TOX 406)

Spring. 3 credits. Prerequisites: BIOES 261 or equivalent; permission of instructor if not an advanced student in natural sciences of engineering. M W F 11:15–12:05. J. W. Gillett.

This course strives to develop understanding of and competence in the different types of ecological (nonhuman health) risk assessments. Focus is on cases for chemical, physical, and biological stressors in a variety of circumstances. The proposed USEPA approach under development serves as the working model.

NTRES 407 Religion, Ethics, and the Environment

Fall. 4 credits. For juniors, seniors, and graduate students; others by permission only. S-U grades optional. T R 10:10–11:00; an hr disc TBA. R. A. Baer.

How religion, philosophy, and ethics influence our treatment of nature. Terms like religion, nature, fact, value, knowledge, and public interest are examined in detail. Particular themes include character and moral development, similarities and differences between moral and scientific claims, truth telling, public reason, and property. Also covers animals rights vs. ecosystem concerns, responsibility to future generations, the limitations of rationalism in ethics, and discussion of whether women approach moral issues differently than men.

[NTRES 408 Resource Management and Environmental Law (also CRP 444)

Fall. 3 credits. For juniors, seniors, and graduate students. S-U grades optional. M W F 9:05–9:55. Not offered fall 2001. Staff.

A senior-level course that introduces the use of legal concepts, doctrines, and remedies in natural resource and environmental management. For a variety of living resources and their habitats, it explores the common law and regulatory processes available for resolving conflicts between exploitation and protection and stresses a practical understanding of how public and private values, economic considerations, and constitutional limitations affect management techniques and objectives.]

NTRES 410 Quantitative Methods in Wildlife Management

Spring. 3 credits. Letter grade only. Prerequisite: NTRES 210, with NTRES 305, strongly recommended. Lec, T R 11:15–12:05; lab, R 2:30–4:25.

An in-depth analysis of the ecological and quantitative dimensions of decision making in modern wildlife management and conservation. This includes analysis of population and systems models for planning and evaluating management decisions, particularly under uncertainty, and methods for adaptive management, techniques which are increasingly important for resource management and conservation. Afternoon lab sessions use case studies, group discussion, and computer-based exercises to reinforce concepts presented in lecture.

NTRES 411 Seminar in Environmental Ethics

Fall. 3 credits. For seniors, juniors and graduate students. S-U grades optional. W 1:25–3:50.

Moral concerns relative to the natural environment and agriculture. Major themes generally include: animal rights vs. ecosystem concerns; natural resource management and the concept of the public interest; applying environmental ethics in a democratic and pluralistic society; how our treatment of one another parallels our treatment of nature; and land use ethics. Several classes focus on the nature of facts, values, knowledge, and truth telling.

NTRES 415 Principles and Practices of Agroforestry (also HORT 415 and CSS 415)

Fall. 3 credits. Prerequisites: senior or graduate standing or permission of instructor. S-U option. Lec, M W F 10:10–11:00. L. Buck, E. Fernandes, K. Mudge.

An introduction to modern and traditional agroforestry systems which involves spatial or temporal integration of multipurpose woody plants (trees and/or shrubs) with annual or perennial crops and/or livestock. Interactions between woody and non-woody components of agroforestry systems are considered, based on above- and below-ground processes. The sustainability of agroforestry systems is critically examined from biophysical, socioeconomic, and policy perspectives. Optional laboratory, NTRES 416 (also CSS and HORT).

NTRES 416 Principles and Practices of Agroforesty—Laboratory (also HORT 416 and CSS 416)

Fall. 1 credit. Optional lab component of NTRES 415 (also HORT and CSS [SCAS]). S-U grades optional. Prerequisites: junior, senior, or graduate standing or permission of instructor; prior or concurrent enrollment in NTRES 415. W 1:25–4:25. K. Mudge, E. Fernandes, L. Buck.

An integrated set of laboratory and field exercises designed to develop competency in diagnostic and management skills applied to agroforestry practice. Sessions include field trips to local practitioners as well as working demonstration farms and forests, case study design and analysis, use of computer-based sources of information, and practical skills with woody plants including identification, propagation, planting, pruning, and measurement.

NTRES 417 Wetland Resources

Summer. 2 credits. Prerequisite: 1 year of college biology. A special 1-week course offered at Cornell's Shoals Marine Laboratory (SML), on an island off Portmouth, N.H. For more details and an application, consult the SML office, G14 Stimson Hall.

An examination of coastal and adjacent freshwater wetlands from historical, disturbance, and preservation perspectives, including fresh and salt water-marsh ecology and management. Field trips to selected examples of the wetlands under discussion and follow-up laboratories emphasize successional features, plant identification and classification, and examination of the dominant insect and vertebrate associations.

NTRES 418 Wetland Ecology and Management-Lecture

Fall. 3 credits. T R 1:25–2:40. B. L. Bedford.

Examination of the structure, function, and dynamics of wetland ecosystems with an emphasis on principles required to understand how human activities affect wetlands. Current regulations, protection programs, and management strategies are considered.

NTRES 419 Wetland Ecology and Management-Laboratory

Fall. 1 credit. Optional. Concurrent enrollment in NTRES 418 is required. W or F 12:20–4:25. 1 weekend fieldtrip required.

An integrated set of laboratory field exercises designed to expose students to: the diversity of wetland ecosystems; the vegetation, soils, water chemistry, and hydrology of wetlands in the region; methods of sampling wetlands

vegetation, soils, and water; and methods of wetland identification and delineation.

NTRES 420 Ecological Management of Water Resources
Spring. 3 credits. Prerequisites: introductory ecology and introductory chemistry or permission of instructor. M W F 9:05–9:55. R. Schneider.
In-depth analysis of those ecological and biological principles relevant to the management of fresh and marine water resources, with emphasis on the effects of water management on community ecology. Lectures and discussion integrate scientific literature with current management issues. Topics include: linkages between hydrologic variability and communities; groundwater-surface connections, flow paths for dispersal, patchily distributed water resources, and water quality controls on organisms.

NTRES 428 Landscape Impact Analysis
Spring. 3 credits. Prerequisites: 1 introductory and 1 advanced course in ecology or the equivalents, and junior standing. T R 1:25–2:40. B. Bedford.
This course presents ecological concepts and analytical tools needed to evaluate environmental impacts to natural resources and ecosystems within an integrated context that incorporates the landscapes in which these resources occur. It explores diverse conceptual frameworks for landscape impact analysis and exposes students to modern tools for evaluating landscapes.

[NTRES 438 Fishery Management
Spring. 3 credits. Lec, T R 10:10; disc, T or R 11:15. Offered alternate years. Next offered spring 2003.
Introduction to management as an adaptive process that focuses on achievement of goals. Coverage includes sport and commercial fisheries and species restoration. Topics include goals and objectives, regulations, habitat management, population control, stocking and management of trout, reservoirs, and the Great Lakes and Pacific halibut. Ecological, social, political, and economic aspects of those topics are discussed.]

NTRES 450 Conservation Biology
Fall. 3 credits. Prerequisite: a reasonable biology background. Limited to first 30 seniors, plus graduate students. Lec, T 10:10–12:05; disc, R 10:10 or 11:15. T. A. Gavin.
Emphasis is on biological topics that are important to the maintenance of biological diversity. Examples include population viability analysis, and the analysis of the demography and genetics of small populations as they are affected by habitat fragmentation and isolation. Students gain thorough familiarity with these concepts and their potential application through lectures, discussion, and use of computer models. This course is intended primarily for students with a background in college biology. Students with no college biology background should enroll in BIOEE 257.

[NTRES 456 Stream Ecology (also ENTOM 456, BIOEE 456)
Spring. 4 credits. Limited to 60 students. Prerequisites: none; BIOEE 261 recommended. Offered alternate odd years. Next offered spring 2003. Lec T R 9:05–9:55; lab T W or R 1:25–4:25. B. Peckarsky.
Lecture addresses the patterns and processes occurring in stream ecosystems, including channel formation, water chemistry, watershed influences, plant, invertebrate, and fish community structure, nutrient cycling, trophic dynamics, colonization and succession, community dynamics, conservation, and the impacts of disturbances. Lab: field projects include descriptive and experimental techniques, hypothesis-testing, and writing of scientific papers related to environmental assessment.]

NTRES 458 Human Dimensions of Natural Resource Management
Spring. 3 credits. S-U grades optional. Limited to juniors and seniors. Lec, T R 11:40–12:55. B. Lauber and J. Enck.
This course focuses on how a social science-based understanding of human attitudes, values, and behaviors can be incorporated in natural resource management decisions and actions. Examples from federal, state, and nongovernmental fish, wildlife, and forest management programs are used to illustrate the importance of socioeconomic considerations in problem solving and decision making.

NTRES 459 Techniques for Demographic Analysis of Wildlife Population
Fall. 3 credits. Letter grade only. Prerequisites: CALS math requirements or permission of instructor. NTRES 305 and/or NTRES 340 suggested. Lec, T R 1:25–2:15; lab, W 1:25–4:25. Offered alternate years. E. Cooch.
This course explores the theory and application of a variety of statistical techniques in the study of population dynamics. Topics include the use of capture-recapture and recovery analysis to estimate survival probability, abundance (and density), immigration, emigration, population growth, and sensitivity analysis, using both open and closed population models. Also examined are inference methods including covariate analysis and model selection.

NTRES 460 Quantitative Ecology of Fisheries Resources
Spring. 3 credits. S-U grades optional. Prerequisites: NTRES 304 recommended or permission of instructor. M W F 10:10–11:00. Offered alternate even years. P. J. Sullivan.
The dynamics of marine and freshwater fisheries resources are examined with a view towards observation, analysis, and decision making within a quantitative framework. Growing pressure on fisheries' resources, habitat modification, and increased uncertainty about the nature of biological systems are at the center of many fisheries' issues. Quantitative models are useful for integrating information needed by decision makers in addressing these issues. The course develops analytical methods to assess the dynamics and status of fisheries' resources and then demonstrates how the information may be transformed into useful information for decision makers.

[NTRES 471 Ecoregions: Ecology and Conservation
Spring. 2 credits. Letter grade only. Prerequisites: NTRES 210, 305; statistics recommended; junior standing or above. Lec/Lab, W 1:25–4:25. Offered alternate odd years. Next offered 2003. C. R. Smith.
Approaches to characterizing and classifying terrestrial habitats and ecoregions at a variety of spatial scales are reviewed and discussed. A landscape approach is used to introduce habitat management concepts and land cover classifications. Legislation guiding federal land management decisions is discussed, and field trips go to areas managed by public and private land management organizations.]

NTRES 493 Individual Study in Resource Policy, Management, and Human Dimensions
Fall, spring, or winter. Credit TBA. S-U grades optional. Prerequisite: permission of instructor. R. A. Baer, T. Brown, L. E. Buck, D. J. Decker, J. Enck, J. Gillett, B. Knuth, T. B. Lauber, R. McNeil.
Topics in environmental and natural resource policy, management, and human dimensions are arranged depending on the interests of students and availability of staff. Students must register with an Independent Study form (available in 140 Roberts Hall).

NTRES 494 Special Topics in Natural Resources
Fall or spring. 4 credits maximum. S-U grades optional.
The department teaches "trial" courses under this number. Offerings vary by semester, and are advertised by the department before the semester starts. Courses offered under the number will be approved by the department curriculum committee, and the same course is not offered more than twice under this number.

NTRES 495 Individual Study in Fish and Wildlife Biology and Management
Fall or spring. Credit TBA. S-U grades optional. Prerequisite: permission of instructor. M. Bain, E. Cooch, P. Curtis, T. Gavin, J. R. Jackson, C. Kraft, R. Malecki, E. Mills, A. Moen, S. Morreale, M. Richmond, L. Rudstam, C. Smith, P. Sullivan.
Topics in fish and wildlife biology and management are arranged depending on the interests of students and availability of staff. Students must register with an Independent Study form (available in 140 Roberts Hall).

NTRES 496 Individual Study in Ecology and Management of Landscapes
Fall or spring. Credit TBA. S-U grades optional. Prerequisite: permission of instructor. B. Bedford, B. Blossey, T. Fahey, M. Krasny, J. Lassoie, R. Schneider, R. Sherman, P. Smallidge, J. Yavitt.
Topics in ecology and management of landscapes are arranged depending on the interests of students and availability of staff. Students must register with an Independent Study form (available in 140 Roberts Hall).

NTRES 498 Teaching in Natural Resources
Fall and spring. 1–4 credits. Prerequisite: permission of instructor. Students must register with an Independent Study form (available in 140 Roberts Hall). S-U grades optional.
Course designed to give students an opportunity to obtain teaching experience by assisting in labs, field trips for designated sections, discussions, and grading. Students gain insight into the organization, preparation, and execution of course plans through application and discussions with instructor.

NTRES 500 Professional Projects—M.P.S.
Fall and spring. Credit TBA. Limited to graduate students working on professional master's projects. S-U grades only.

NTRES 507 Environmental Inquiry (also EDUC 507)
Summer. 1–3 credits. S-U grades optional. Prerequisite: limited to preservice or inservice secondary science teachers. Permission of one of the instructors required. W. S. Carlsen and M. E. Krasny.
Exploration of selected topics in environmental science and environmental science education at the secondary school level. The subject-matter focus varies from year to year, and tracks ongoing research and development conducted through Cornell's Environmental Inquiry project, a collaboration between the Departments of Education and Natural Resources and the Center for the Environment. Current work centers on watershed dynamics, biodegradation, environmental toxicology, and invasive species.

NTRES 600 Introduction to Graduate Study in Natural Resources
Fall. 2 credits. Prerequisite: course is open to beginning graduate students whose faculty advisers are in Natural Resources. S-U grades. Lec, Weekdays TBA, 3:00–5:00. M. E. Krasny.
Designed for beginning Natural Resources graduate students, this course includes faculty-led discussions of key natural resources issues, student discussions of research ideas, and skill building sessions on proposal writing and giving research presentations. Students are required to complete a research proposal.

NTRES 601 Seminar on Selected Topics in Natural Resources
Fall or spring. 1 credit. S-U grades only. T 3:35–4:25; disc sec, T 4:30–5:00.
Selected readings and discussions of research and/or current problems in natural resources.

[NTRES 604 Seminar on Selected Topics in Resource Policy and Management
Fall. 2 credits. S-U grades only. M 3:00–4:30. Not offered in 2001–2002.
Primarily for graduate students with a major or minor in resource policy and management and upper level undergraduates with a strong interest in resource policy analysis. Topics include the policy process, actors and stakeholders, ethical dimensions, and evaluation. Emphasis is placed on discussion, faculty-student interaction, communication skills, and current resource policy issues.]

NTRES 605 Issues in Risk Analysis Seminar (also CEE 605)
Fall. 1 credit. Prerequisite: calculus, advanced course in statistics and basic natural sciences (Chemistry, Biology, Earth Systems). S-U only. Lec, TBA. J. Gillett and R. Davidson.
Discussion of current issues and ongoing research on risk analysis issues from many perspectives with an emphasis on environmental risk analysis. Speakers address problem formulation, quantitative/qualitative methods in assessment of risks, communication issues, and challenges to risk assessment methodologies. Some sessions held jointly with other seminar series. Enrollment in seminar requires short reports and participation in two required discussion meetings for class members designed to integrate the issues raised during the semester.

NTRES 607 Ecotoxicology (also TOX 607)
Spring. 3 credits. Prerequisites: graduate or senior status and two 300-level courses in chemistry, biological science, or toxicology. M W F 11:15–12:05. Offered alternate even years. J. W. Gillett.
Lectures, readings, and special guests focus on the principles of effects of toxic chemicals on natural ecosystems, their components, and processes. Major topics include fate and transport of chemicals (chemodynamics), comparative biochemical toxicology, ecosystem process analysis, simulation through mathematical and physical (microcosm) models, and relationships to regulation and environmental management.

NTRES 612 Wildlife Science Seminar
Fall and spring. 1 credit. Prerequisite: permission of instructor. S-U grades only. Check with department for availability. Staff.
Discussion of individual research or current problems in wildlife science.

NTRES 615 Case Studies and Special Topics in Agroforestry
Spring. 2 credits. Prerequisites: NTRES/CSS/HORT 415 or permission of instructor. S-U grades optional. W 1:25–3:20. L. E. Buck.
Interdisciplinary groups of students examine case study examples of agroforestry practice and research in developed and developing countries. Key current topics in the field are examined in depth, through lecture presentations, library research, and class discussion. Students prepare individual or team-written original case studies or critical analyses of existing case studies for presentation to class.

NTRES 616 Forest Science and Management Seminar
Fall. 2 credits. For graduate students and upper-level undergraduates. Time TBA, organizational meeting to be scheduled. J. B. Yavitt.
This seminar course includes review of current literature, student research, and selected topics of interest. Topics include biogeography, ecology, and human use of forests located in boreal, temperate, and/or tropical environments.

NTRES 618 Critical Issues in Conservation and Sustainable Development
Fall. 3 credits. Preference to graduate students with minor in conservation and sustainable development; seniors by permission. Limited to 30 students. T R 2:30–4:25. Staff.
Establishes a conceptual foundation for analyzing and addressing conservation and development issues from an interdisciplinary perspective. Engages students in the inherent conflicts between natural resource conservation and rural development. Students work in interdisciplinary groups to analyze issues and cases from both developing and developed countries.

NTRES 619 Field Practicum in Conservation and Sustainable Development
Spring. 3 credits. Prerequisites: NTRES 618; preference given to graduate students with minor in conservation and sustainable development; permission of instructor. Limited to 12 students. Includes 2-week field study trip to a Latin American country in January.
An interdisciplinary study of a conservation and development problem in Latin America. The course uses an interdisciplinary research methodology that includes group problem identification, individual or rapid appraisal projects, and synthesis of group work to identify key conservation and development issues and research priorities for a selected site.

NTRES 659 Techniques for Demographic Analysis of Wildlife Population
Fall. 3 credits. Letter grade only. Prerequisites: CALS math requirements or permission of instructor. Lec, T R 1:25–2:15 P.M.; lab, W 1:25–4:25 P.M. Offered odd years. E. Cooch.
This course explores the theory and application of a variety of statistical techniques in the study of population dynamics. Topics covered include the use of capture-recapture and recovery analysis to estimate survival probability, abundance (and density), immigration, emigration, population growth, and sensitivity analysis, using both open and closed population models. Also examined are inference methods including covariate analysis and model selection. Students enrolling for graduate credit do extra work beyond that expected for undergraduates in the 400-level course (NTRES 459).

NTRES 660 Quantitative Ecology of Fisheries Resources
Spring. 3 credits. S-U grades optional. Prerequisites: NTRES 304 recommended or permission of instructor. M W F 10:10–11:00. Offered even years. P. J. Sullivan.
This course is taught in conjunction with NTRES 460 (see description above). Students taking the course for graduate credit are asked, in addition to the 400-level projects and homework, to construct and document a model of population or community dynamics that reflects and extends the concepts covered in the course.

[NTRES 670 Spatial Statistics
Spring. 3 credits. Prerequisites: BTRY 601 and 602; an intro GIS course strongly recommended. S-U grades optional. M W F 10:10–11:00. Offered alternate odd years. Next offered spring 2003. P. J. Sullivan.
Spatial statistical concepts and techniques are developed and applied to ecological and natural resource issues. Topics include visualizing spatial data and analysis and modeling of geostatistical, lattice, and spatial point processes. Students should consider taking this course simultaneously with CSS 620.]

NTRES 694 Special Topics in Natural Resources
Fall or spring. 4 credits maximum. S-U grades optional.
The department teaches "trial" courses under this number. Offerings vary by semester, and are advertised by the department before the semester starts. Courses offered under the number will be approved by the department curriculum committee, and the same course is not offered more than twice under this number.

NTRES 698 Current Topics: Environmental Toxicology (also TOX 698)
Fall, spring. 1–3 credits. Prerequisites: graduate or senior standing in scientific discipline and permission of instructor.
A student-faculty colloquium on subjects of current interest, usually focusing on multidisciplinary aspects of topical problems (e.g., Superfund, oil spills).

NTRES 699 Graduate Individual Study in Natural Resources
Fall or spring. Credit TBA. S-U grades optional. Prerequisite: permission of instructor. NTRES graduate faculty.
Study of topics in natural resources more advanced than, or different from, other courses. Subject matter depends on interests of students and availability of staff.

NTRES 800 Master's Thesis Research
Fall and spring. Credit TBA. Limited to graduate students working on master's thesis research. S-U grades only.

NTRES 900 Graduate-Level Thesis Research
Fall and spring. Credit TBA. Limited to graduate students in a Ph.D. program **only before** the "A" exam has been passed. S-U grades only.

NTRES 901 Doctoral-Level Thesis Research
Fall and spring. Credit TBA. For students admitted to candidacy **after** the "A" exam has been passed. S-U grades only.

Related Courses in Other Departments

Courses in many other departments are relevant to students majoring in Natural Resources. The following list includes some of the most closely related courses but is not exhaustive.

Environment and Society (R SOC 208, 324, 340, 410, 440, 495)
Ecology and Biology (ENTOM 370, 456, 470, 471; BIOEE 261, 263, 274, 278, 452, 457, 459, 461, 462, 463, 465, 466, 468, 471, 472, 475, 476, 478; BIOMI 290–292, 397, 418)
Environmental Law, Ethics, and Philosophy (S&TS 206; CRP 390, 443, 444, 451, 453; PHIL 241, 246, 247, 381)
Human Systems and Communication (COMM 260, 285, 352, 421)
Physical Sciences (ABEN 151, 301, 371, 425, 435, 471, 473, 475, 478; CSS and EAS 260, 321, 365, 371, 398, 483; EAS 102, 104; CEE 432)
Public Policy and Politics (GOVT 427, 428; BIO & SOC 461; CEE 529)
Resource Economics (AEM 250, 450, 451)
Spatial Data Interpretation (CSS 411, 420, 620, 660)

PLANT BREEDING

T. Brutnell, W. R. Coffman, W. De Jong, J. Doyle, E. D. Earle, S. Kresovich, M. M. Jahn, S. R. McCouch, M. A. Mutschler, K. V. Raman, M. E. Smith, M. E. Sorrells, S. D. Tanksley, D. R. Viands, K. Watanable

Emeritus Professors: R. E. Anderson, H. L. Everett, H. M. Munger, R. P. Murphy, W. D. Pardee, R. L. Plaisted, D. H. Wallace

Note: class meeting times are accurate at the time of publication. If changes are necessary, the department will provide new information as soon as possible.

PL BR 201 Plants, Genes, and Global Food Production
Spring. 2 credits. Prerequisite: 1 year of introductory biology or permission of instructor. Lecs, T R 11:15. S. R. McCouch.
This course provides an introduction to plant breeding. It offers a sense of the historical and social importance of the field, tracing its evolution from the pre-scientific days of crop domestication to modern applications of biotechnology. It offers specific examples of how breeding objectives are realized and raises questions about the environmental, social, and economic consequences of intensive food production systems. This course may be used for partial fulfillment of the CALS distribution requirement GROUP B—Biological Sciences.

PL BR 225 Plant Genetics
Spring. 2 or 3 credits (2 credits if taken after BIOGD 281). Prerequisites: 1 year of introductory biology or equivalent; permission of instructor required for students who have taken BIOGD 281. Lecs, M W 11:15-12:05; lab, R 1:25–4:25. M. Jahn and M. Mutschler.
This course surveys the fundamentals of plant genetics. It shows how this information is used in plant biology and allied agricultural sciences and provides a basis for understanding the complex issues related to modern crop genetics. Topics include simple inheritance, linkage analysis, polyploidy, analysis of nuclear, chloroplast and mitochondrial genomes, pollination controls, and methods for analysis and manipulation of genes, chromosomes, and whole genomes. Examples and materials are drawn from diverse crops and plant species.

PL BR 401 Plant Cell and Tissue Culture
Fall. 3 credits. Prerequisites: a course in plant biology or genetics, or permission of instructor. Lecs, T R 10:10. E. D. Earle.
Lectures and demonstrations dealing with the techniques of plant tissue, cell, protoplast, embryo, and anther culture and the applications of those techniques to biological and agricultural studies. Methods for plant improvement via manipulations of cultured cells are discussed.

PL BR 402 Plant Tissue Culture Laboratory
Fall. 1 credit. Enrollment limited. Prerequisites: PL BR 401 (may be taken concurrently) or permission of instructor. W or R 1:25–4:25 (alternate weeks) plus 1 hr TBA. E. D. Earle.
Laboratory exercises complementing PL BR 401. Techniques for establishing, evaluating, and utilizing plant organ, tissue, and cell cultures are covered. Experiments use a broad range of plant materials and include *Agrobacterium*-mediated gene transfer.

PL BR 403 Genetic Improvement of Crop Plants
Fall. 3 credits. Prerequisites: genetics (BIOGD 281 or other standard genetics course), and a course in crops or horticulture. M W F 9:05–9:55. M. E. Smith.
Genetic enhancement of crop value to humans began with domestication and continues with farmers' variety development and scientifically trained plant breeders' applications of Mendelian, quantitative, and molecular genetics. This course examines crop genetic improvement methods by discussing the history and current practice of plant breeding, tools available to breeders, choices and modifications of those tools to meet specific objectives, and challenges plant breeders face in developing varieties for the future.

PL BR 404 Crop Evolution, Domestication and Diversity (also BIOPL 404)
Spring. 2 credits. S-U letter. Prerequisites: Genetics 281 or Plant Breeding 225 or permission of the instructor. Lecs, T R 9:05. S. Kresovich.
Evolution, domestication, and breeding of crop plants have molded the current diversity we conserve and use. Based on advances in systematics and molecular genetics, this course presents an integrated approach to understanding and describing diversity of agricultural and horticultural species. Underlying ethical, legal, and social issues affecting conservation and use also are addressed.

PL BR 446 Plant Cytogenetics Laboratory
Fall. 1 credit. S-U only. Prerequisites: a course in genetics or permission of instructor. Will be offered as a 2-week module at a time to be arranged in fall 2001. Check with department for further information. K. N. Watanabe.
This course aims to provide fundamental knowledge and techniques in plant cytogenetics. Emphasis is on applications to research on plant genetics and plant breeding. Plant materials involve a wide range of crop species. Basic techniques for examination of plant chromosomes are covered.

PL BR 494 Special Topics in Plant Breeding
Fall or spring. 4 credits maximum. S-U grades optional.
The department teaches "trial" courses under this number. Offerings vary by semester, and are advertised by the department before the semester starts. Courses offered under the number will be approved by the department curriculum committee, and the same course is not offered more than twice under this number.

PL BR 496 Internship in Plant Breeding
Fall or spring. Credits variable, may be repeated to a maximum of 6. Minimum of 60 on-the-job hours per credit granted. Prerequisites: permission of adviser and enrollment during the pre-enrollment period of the semester before the internship. Student must be a plant breeding junior or senior with a minimum 3.0 average in plant breeding courses. Students must attach to their course enrollment materials a "CALS Independent Study, Research, Teaching, or Internship" form signed by the faculty member who will supervise their study and assign their credits and grade. S-U grades only. Staff.
On-the-job learning experience under the supervision of professionals in a cooperating organization. A learning contract is written between the faculty supervisor and student, stating the conditions of the work assignment, supervision, and reporting.

PL BR 497 Individual Study in Plant Breeding
Fall or spring. Credits variable, may be repeated to a maximum of 6. S-U optional. Prerequisite: permission of instructor. Students must register with an Independent Study form (available in 140 Roberts Hall). Staff.

PL BR 498 Undergraduate Teaching
Fall or spring. Credits variable, may be repeated to a maximum of 6. S-U optional. Prerequisites: permission of instructor, and previous enrollment in course to be taught or equivalent. Students must register with an Independent Study form (available in 140 Roberts Hall). Staff.
Undergraduate teaching assistance in a plant breeding course. Teaching experience may include leading a discussion section, preparing and teaching laboratories, and tutoring.

PL BR 499 Undergraduate Research
Fall or spring. Credits variable. S-U optional. Prerequisite: permission of instructor. Students must register with an Independent Study form (available in 140 Roberts Hall). Staff.
Undergraduate research projects in plant breeding.

PL BR 604 Methods of Plant Breeding Laboratory
Fall. 2 credits. Prerequisite: PL BR 403 or equivalent (may be taken concurrently). T R 1:25–4:15. M. E. Sorrells and R. E. Anderson.
Field trips to plant breeding programs involve discussion of breeding methods used, overall goals, selection and screening techniques, and variety and germ plasm release. Additional labs include use of computers in plant breeding research and selection techniques for disease resistance. For a term project each student designs a comprehensive breeding program on a chosen crop.

PL BR 606 Advanced Plant Genetics
Spring. 3 credits. S-U grades optional. Prerequisites: BIOGD 281 or equivalent. Lecs, T R 1:25–2:40. W. S. De Jong.
Provides an advanced survey of genetics in higher plants. Topics include discussion of the complete genome sequence of Arabidopsis, forward and reverse genetic analyses of biochemical and developmental pathways, mating behavior and barriers, polyploidy, transposable elements, and the relationship between nuclear and chromosome structure and gene expression.

PL BR 607 Analysis of Sequence Similarity
Fall. 1 credit. Enrollment limited. S-U grades only. Prerequisites: basic biology, basic genetics, familiarity with computers. Permission of instructor required. M W F 11:15–12:05 for 4 weeks. Dates TBA. Check with Plant Breeding Office after June for details. D. Schneider.
This course focuses on the tools available for accessing nucleotide and protein sequence similarity in plants, animals, and microbes and the strengths and limitations of these approaches for answering biological questions. The mathematical and statistical background of the algorithms is presented in lectures, and weekly on-line projects provide students with experience in addressing a range of biological problems involving sequence analysis.

[PL BR 610 Advanced Plant Breeding Methods
Spring. 3 credits. Prerequisites: PL BR 403 or equivalent, BIOGD 281 or equivalent. M W F 12:20–1:10. Not offered 2001–2002. M. Mutschler.
This course integrates information from a variety of disciplines to examine current issues in plant breeding. Topics covered include: issues surrounding the maintenance, selection, and use of germplasm resources; traditional plant breeding methods used for a variety of crops; integration of biochemical and molecular techniques into an applied breeding program; the effect of crop and breeding objectives on the success of breeding strategies; and intellectual property protection and its impact on breeding goals and strategies.]

[PL BR 618 Breeding for Pest Resistance
Fall. 2 credits. S-U grades optional. Prerequisites: BIOGD 281 and PL BR 403 or equivalents. An introductory course in Plant Pathology and/or Entomology also highly recommended. Lecs, M F 2:30–3:20. Offered alternate years. P. Griffiths.
A multidisciplinary examination of the challenge of incorporating disease and insect resistance into crop plants. Topics covered include national and international germplasm collections, identification of sources of resistance, resistance mechanisms in plants, monogenic and polygenic control of resistance, approaches to breeding for resistance, stability of genetic resistance mechanisms, and the use of biochemical, physiological, and molecular tools in breeding for pest resistance.]

PL BR 622 Seminar
Fall or spring. 1 credit. S-U grades only. T 12:20–1:10. Staff and graduate students.

PL BR 650 Special Problems in Research and Teaching
Fall or spring. 1 or more credits. Prerequisite: permission of instructor supervising the research or teaching. Staff.

PL BR 653.2 Plant Biotechnology (also PL PA 663 and BIO PL 653.2)
Fall. 1 credit. S-U grades optional. Prerequisite: BIO PL 653.1 or permission of instructor. Lecs, M W F 1:25–2:15 (12 lecs) Oct. 1–Oct. 29. E. D. Earle and M. Zaitlin.
This course deals with production and use of transgenic plants for agricultural and industrial purposes. Topics include procedures for gene introduction and control of gene expression, as well as strategies for obtaining transgenic plants that are resistant to insects, diseases, and herbicides, produce useful products, or have improved nutritional and food processing characteristics. Regulatory and social issues relating to plant biotechnology are discussed.

[PL BR 653.3 Plant Genome Organization (also BIO PL 653.3)
Fall. 1 credit. S-U grade or letter option. Prerequisites: BIO PL 653.1. M W F 10:10–11:00. (12 lecs) Offered alternate years. Not offered 2001–2002. S. D. Tanksley.
The structure and variation of plant nuclear genomes, including changes in genome size, centromere/telomere structure, DNA packaging, transposable elements, genetic and physical mapping, positional gene cloning, genomic sequencing, and comparative genomics.]

PL BR 653.6 Molecular Breeding (also BIOPL 653.6)
Fall. 1 credit. S-U grade or letter option. Lecs, M W F 10:10–11:00 (12 lecs) Oct. 1–Oct. 29. Offered alternate years. S. Tanksley.
Application of DNA markers to the identification, manipulation and isolation of genes important to plant and animal productivity using molecular genetic techniques. Students learn how to design and execute experiments to identify quantitative trait loci (QTLs), as well as how to apply molecular markers to plant and animal breeding programs.

PL BR 694 Special Topics in Plant Breeding
Fall or spring. 4 credits maximum. S-U grades optional.
The department teaches "trial" courses under this number. Offerings vary by semester, and are advertised by the department before the semester starts. Courses offered under the number will be approved by the department curriculum committee, and the same course is not offered more than twice under this number.

PL BR 694.1 Intellectual Property Management for Plant Scientists
Spring. 3 credits. S-U grades optional. Prerequisite: functioning knowledge of plant sciences or permission of instructor. Lecs, W 1:25–4:25. A. F. Krattiger and R. D. Kryder.
A comprehensive introductory course for plant scientists and research administrators on the management of intellectual property (IP) and institutional IP strategies. Topics include: plant patents and utility patents (US and ex-US); plant variety protection/Plant Breeders' Rights; contracts and agreements (confidentiality, employment, material transfer, collaboration, consulting, licensing); technology valuation; IP management and strategies (laboratory notebooks, institutional management, Freedom-to-Operate reviews, IP audits, portfolio management); bioprospecting and genetic resource issues; and negotiation and litigation.

[PL BR 716 Perspectives in Plant Breeding Strategies
Spring. 3 credits. S-U grades optional. Prerequisite: PL BR 403. W 3:35–5:15, F 3:35–4:25. Next offered spring 2003. M. E. Sorrells.
Emphasis is on discussion and evaluation of selected benchmark papers and current literature. Selection techniques and breeding objectives, methods, and strategies for both self- and cross-pollinated crops are reviewed and discussed. Extensive outside reading is required.]

PL BR 717 Quantitative Genetics in Plant Breeding
Spring. 3 credits. S-U grades optional. Prerequisites: PL BR 403 and BTRY 601 or equivalent. M F 2:55–4:10. Offered even years. D. R. Viands and M. E. Sorrells.
Discussion of quantitative genetics and quantitative trait loci (QTLs) for more efficient plant breeding. Specific topics include: components of variance (estimated from various mating designs); theory and computer analysis for QTL, population structure, multiple locus regressions, and interval analysis; heritability; theoretical gain from selection; and genotypic and phenotypic correlation coefficients. During one period, plants in the greenhouse are evaluated to provide data for computing quantitative genetic parameters.

PL BR 726 Problems and Perspectives in Computational Molecular Biology (also CS 726)
Fall, spring. 1 credit. S-U only. Prerequisites: permission of the instructor. Disc, W 2:55. R. Elber and S. McCouch.

A weekly seminar series discussing timely topics of Computational Molecular Biology. This course addresses methodological approaches to gene annotation, protein structure and function relationships, and evolutionary relationships across species. Statistical and deterministic computational approaches are covered (e.g. psi-Blast, Hidden Markov Models, Threading, Evolutionary models), and specific and detailed biological examples are discussed.

PL BR 800 Master's-Level Thesis Research
Fall or spring. Credit TBA. Prerequisite: permission of instructor. S-U grades optional. Graduate faculty.
For students working on a master's thesis.

PL BR 900 Graduate-Level Dissertation
Fall or spring. Credit TBA. Prerequisite: permission of instructor. S-U grades optional. Graduate faculty.
For students in a Ph.D. program **only before** the "A" exam has been passed.

PL BR 901 Doctoral-Level Dissertation Research
Fall or spring. Credit TBA. Prerequisite: permission of instructor. S-U grades optional. Graduate faculty.
For students admitted to candidacy **after** the "A" exam has been passed.

PLANT PATHOLOGY

R. Loria, chair; J. R. Aist, P. A. Arneson, S. V. Beer, G. C. Bergstrom, B. B. Brodie, A. R. Collmer, T. P. Delaney, W. E. Fry, S. M. Gray, K. T. Hodge, G. W. Hudler, J. A. Laurence, S. G. Lazarowitz, J. W. Lorbeer, G. B. Martin, M. T. McGrath, M. G. Milgroom, E. B. Nelson, B. G. Turgeon, M. Zaitlin, T. A. Zitter

Note: class meeting times are accurate at the time of publication. If changes are necessary, the department will provide new information as soon as possible.

PL PA 101 Freshman Writing Seminar: Pests, Pesticides, People, and Politics
Spring. 3 credits. Limited to 17 students. Lecs, M W F 8:00. P. A. Arneson.
This seminar examines the use of pesticides, their impact on human health and the environment, and their regulation. Beginning with Rachael Carson's classic *Silent Spring*, the course examines many facets of the pesticide controversy through readings in current popular literature, technical journals, government documents, industry propaganda, and publications of various so-called "public interest groups." The need for critical thinking is emphasized as students explore the power of the written word to persuade.

PL PA 201 Magical Mushrooms, Mischievous Molds
Spring. 2 credits. S-U optional. Lecs, T R 11:15. G. W. Hudler.
A presentation of the fungi and their roles in nature and in shaping past and present civilizations. The historical and practical significance of fungi as decayers of organic matter, as pathogens of plants and animals, as food, and as sources of mind-altering chemicals are emphasized.

PL PA 241 Plant Diseases and Disease Management
Spring. 4 credits. Prerequisite: one year of biology. Lecs, M W F 11:15; lab, T or W 1:25. W. E. Fry.
An introduction to plant diseases, their diagnosis, and their management. Topics covered include: fungi, bacteria, viruses, nematodes, and other plant pathogens; disease cycles, plant disease epidemiology, disease forecasting, and the principles and practices of plant disease management. This course is intended for students who want a practical knowledge of plant diseases and their control. It is not an adequate prerequisite for plant pathology courses numbered 600 and above.

PL PA 309 Introductory Mycology
Fall. 3 credit. Prerequisite: 1 year of biology. Concurrent registration in PL PA 319 is recommended. Lec, T R 9:05–9:55; lab R 1:25–4:25. K. T. Hodge.
A survey of the astounding kingdom of fungi, including mushrooms, molds, yeasts, athlete's foot, fairy rings, and the blue stuff in blue cheese. The course covers fungal biodiversity and systematics, how fungi work, and their roles in the environment and in human affairs. Students work with preserved and living fungi and learn basic identification skills. Grades are based on two prelims, a final exam, and a culture collection project.

PL PA 319 Field Mycology
Fall, weeks 1–8. 1 credit. Letter grades only. Lab, W 1:25–4:25 and W 7:30–9:25 P.M. K. T. Hodge.
Learn to identify mushrooms and other macrofungi on a series of eight afternoon field trips followed by evening lab sessions. Fungi are collected during afternoon trips to sites around Ithaca. In the evenings, students use technical keys and microscopes to identify the fungi and learn about their ecology. The course runs only the first eight Wednesdays of Fall semester. Grades are based on a collection projection and a final laboratory examination.

PL PA 401 Basic Plant Pathology
Fall. 4 credits. Prerequisite: 1 year of biology and BIO PL 241 or equivalent. Recommended: general microbiology, plant physiology. Lecs, T R 11:15, F 12:20; lab, T or W 1:25. M. G. Milgroom.
Principles and practice of plant pathology. Lectures and labs are coordinated to consider types of plant pathogens and their population dynamics, disease cycles, diagnostic criteria and procedures, mechanisms of pathogen attack and plant defense, vector relationships, epidemiology, disease forecasting, loss assessment, and disease control. This course prepares students for graduate-level work in plant pathology.

PL PA 407 Nature of Sensing and Response: Signal Transductions In Biological Systems (also BIO BM 407)
Spring. 3 credits. Prerequisites: BIO BM 330 or 333 or 331 and previous or concurrent registration in 332. Recommended: BIO GD 281. Lec, T R 10:10–11:25. T. P. Delaney.
The responses of organisms and cells to their surroundings are examined to illustrate how biological systems sense their biotic and abiotic environment and communicate sensing into appropriate responses. A wide variety of response systems are explored to identify their unique features and to illustrate how similar processes are utilized by widely divergent organisms. Examples are drawn from prokaryote, plant and animal systems for environmental sensing, control of development and responses during disease. Discussion also examines the role of genetics and biochemistry in understanding signal transduction pathways, as well as the way these systems are perturbed by mutation and disease.

PL PA 411 Plant Disease Diagnosis
Fall. 3 credits. Limited to 18 students. Prerequisites: PL PA 241 or equivalent and permission of instructor. Lec, T R 10:10; lab T R 1:25–4:25. Offered alternate years. G. W. Hudler.
A method of diagnosing plant diseases caused by infectious and noninfectious agents is taught with emphasis on application of contemporary laboratory techniques and effective use of the literature. After seven weeks of formal lecture and laboratory sessions, students spend the rest of the semester working on their own to determine the causes of plant diseases on samples that have either been received by the Plant Disease Diagnostic Lab or that have been prepared by instructors.

[PL PA 443 Pathology and Entomology of Trees and Shrubs (also ENTOM 443)
Fall. 4 credits. Limited to 30 students. Prerequisites: PL PA 241 or equivalent, ENTOM 212 or equivalent. Lec, M W F 11:15; lab F 1:25–4:25. Offered alternate years. Next offered 2002. G. W. Hudler, P. A. Weston.
For students preparing for careers in horticulture, urban forestry, natural resources, and pest management. Deals with identification, impact, assessment, biology, and management of insects and diseases that damage trees and shrubs. Emphasis is on pests of northeastern flora but examples from other parts of the country and the world are also used. Forest, shade, and ornamental plants are considered.]

PL PA 444 Integrated Pest Management (also ENTOM 444)
Fall. 4 credits. Prerequisites: BIO ES 261, ENTOM 212 or 241, or PL PA 241 or their equivalents or permission of instructor. P. A. Arneson and J. Losey.
Lectures integrate the principles of pest control, ecology, and economics in the management across multiple systems. Laboratories consist of exercises to reinforce concepts presented in lecture and demonstrate pest monitoring techniques and the application of computer technology to management problems.

PL PA 472 Microbial Control of Plant Diseases
Spring. 3 credits. Limited to 20 students. Prerequisites: PL PA 241 or PL PA 401, BIOMI 290, or equivalent. Lecs, M W F 9:05–9:55. E. B. Nelson.
This course is intended to provide students with a broad exposure to the field of biological disease control. The basic ecological concepts and principles underlying microbial interactions with plants, as well as plant pathogens, and the role of these interactions in the suppression of fungal and bacterial diseases are discussed. Emphases is placed equally on biological control processes in rhizosphere and phylloplane habitats. Topics address aspects of root and leaf

microbial ecology, plant pathogen ecology and behavior, ecological and molecular mechanisms of biological disease control, and manipulation and enhancement of biological control processes. Applied aspects such as delivery approaches, commercialization and registration of biological control organisms, and implementation of biological disease control practices in agriculture are also covered.

PL PA 494 Special Topics in Plant Pathology
Fall or spring. 4 credits maximum. S-U grades optional.
The department teaches "trial" courses under this number. Offerings vary by semester, and are advertised by the department before the semester starts. Courses offered under the number will be approved by the department curriculum committee, and the same course is not offered more than twice under this number.

PL PA 497 Independent Study
Fall or spring. 1–5 credits. Students must register with an Independent Study form (available in 140 Roberts Hall). S-U grades optional.
An opportunity for independent study of a special topic in mycology or plant pathology under the direction of a faculty member.

PL PA 498 Teaching Experience
Fall or spring. 1–5 credits. Students must register with an Independent Study form (available in 140 Roberts Hall). S-U grades optional.
Undergraduate teaching assistance in a mycology or plant pathology course by mutual agreement with the instructor.

PL PA 499 Undergraduate Research
Fall or spring. 3–5 credits. Students must register with an Independent Study form (available in 140 Roberts Hall). S-U grades optional.
An opportunity for research experience under the direction of a faculty member.

PL PA 642–661 Special Topics Series
Unless otherwise indicated, the following description applies to courses 642–661.
Fall or spring. 1 credit. Prerequisite: permission of instructor. S-U grades only.
Weekly discussions of current topics in special areas of plant pathology and mycology. Students are required to do extensive reading of current literature and to present oral and written reports.

PL PA 642 Plant Disease Epidemiology
Fall. TBA. M. G. Milgroom.

PL PA 644 Ecology of Soil-Borne Pathogens
Fall. R 12:20. E. B. Nelson.

PL PA 645 Plant Virology
Fall. F 12:20. S. M. Gray.

PL PA 647 Bacterial Plant Diseases
Fall and spring. M 9:05. S. V. Beer.
Emphasizes current research in phytobacteriology undertaken in laboratories at Cornell.

[PL PA 648 Molecular Plant Pathology
Fall. R 12:20. Not offered 2001.
T. P. Delaney.]

[PL PA 649 Mycology Conferences
Fall. 1 credit. TBA. Not offered 2001.
K. T. Hodge.]

PL PA 650 Diseases of Vegetable Crops
Fall. TBA. Hours TBA. J. W. Lorbeer and T. A. Zitter.

[PL PA 652 Field Crop Pathology
Spring. W 8:00. Not offered 2001–2002.
G. C. Bergstom.]

PL PA 655 Integrated Pest Management in Tropical Agriculture (also ENTOM 644)
Spring. T 12:20. P. A. Arneson.

PL PA 661 Diagnostic Lab Experience
Summer and fall. 1 or 2 credits. S-U grades only. Requires 3 hrs/wk per credit hour. Hours TBA. T. A. Zitter.
For graduate students and advanced undergraduates with a special interest in diagnosing plant diseases. Students work in the Diagnostic Laboratory (Plant Pathology Department) under supervision of the diagnostician. Coursework or experience in diagnostic techniques is strongly advised. Priority is given to graduate students in plant pathology and plant protection.

PL PA 662 Molecular Plant-Pathogen Interactions (also BIOPL 652.1)
Spring. 1 credit. Prerequisites: BIOGD 281, BIOBM 330 or 331, and BIOMI 653.1. Lecs, M W F 10:10 (12 lecs) Jan. 21–Feb. 15. T. P. Delaney, A. R. Collmer, S. G. Lazarowitz.
An examination of the molecular properties that control the development of host-parasitic interactions in both microorganisms (bacteria, viruses, and fungi) and higher plants. Contemporary theories describing the genetic and molecular mechanisms of microbial pathogenesis and plant resistance are discussed.

PL PA 663 Plant Molecular Biology 1
Fall. 1–5 credit. Prerequisites: BIO GS 281, BIO BM 330 or 331.

Section 01 Concepts and Techniques in Plant Molecular Biology (BIO PL 653.1)
1 credit. Lec, M W F 10:10 (12 lecs). Sept 3–Sept 28. T. P. Delaney, G. B. Martin.
This is an introductory module that provides a broad overview of molecular biology concepts relevant to the plant sciences, and serves as a prerequisite to other modules in the BIO PL 653 (Fall) and BIO PL 652 (Spring) series. The course is divided into two sections: 1) gene discovery, which covers genetic, molecular, and genomics approaches to the isolation of plant genes; and 2) gene characterization, which covers DNA sequencing, DNA and RNA blotting, use of gene databases, and various approaches to producing transgenic plants. Emphasis is on understanding the appropriate approach that is needed for different experiments.

Section 02 Plant Biotechnology (BIO PL 653.2 and PL BR 653.2)
1 credit. Lecs, M W F 1:25 (12 lecs) Oct. 1–Oct. 29. M. Zaitlin, E. D. Earle.
This course deals with production and uses of transgenic plants for agricultural and industrial purposes. Topics include procedures for gene introduction and control of gene expression, as well as strategies for obtaining transgenic plants that are resistant to insects, diseases, and herbicides, produce useful products, or have improved nutritional and food processing characteristics. Regulatory and social issues relating to plant biotechnology are discussed.

PL PA 681 Plant Pathology Seminar
Fall and spring. 1 credit. Required of all plant pathology majors. S-U grades only. W 12:20–1:10.

PL PA 694 Special Topics in Plant Pathology
Fall or spring. 4 credits maximum. S-U grades optional.
The department teaches "trial" courses under this number. Offerings vary by semester, and are advertised by the department before the semester starts. Courses offered under the number will be approved by the department curriculum committee, and the same course is not offered more than twice under this number.

PL PA 701 Concepts of Plant Pathology: Organismal Aspects
Spring. 3 credits. For graduate students with majors or minors in plant pathology; others by permission. Prerequisites: PL PA 401 or equivalent and permission of instructor. Lecs, T R 9:05; lab/disc, R 2–4:25. A. R. Collmer.
Concepts in host-pathogen relationships with emphasis on roles of molecules and cells in determining the outcome of an interaction. Genetic, molecular biological, physiological, and cell biological approaches to experimental analysis of exemplary host-pathogen systems are considered. Historical perspectives and recent research are reviewed and analyzed. Students prepare and review mock grant proposals.

PL PA 702 Concepts of Plant Pathology: Population Aspects
Fall. 3 credits. For graduate students with a major or minor in plant pathology; others by permission. Prerequisite: PL PA 401 or permission of instructor. Some background in statistics is recommended.
Lab=discussion section. Lec, T R 10:10; disc, T 2–4:25. M. G. Milgroom.
Theory and concepts in population biology, with emphasis on evolution and epidemiology of plant pathogens. Interactions of plant and pathogen populations are considered within a population biology framework that integrates evolution, genetics, and ecology. The discussion section is used for examining current research literature and other exercises complementary to lecture topics; emphasis is on critical thinking in science.

PL PA 705 Phytovirology
Spring. 2 credits. For graduate students with a major or minor in plant pathology; others by permission. Prerequisite: PL PA 401 or equivalent. S. G. Lazarowitz.
This course considers plant viruses and the diseases they cause. Consideration is given to virus structure and composition, classification, replication, effects on hosts, modes of transmission, and the relationships of these aspects to principles of diagnosis and control.

[PL PA 707 Phytobacteriology
Fall. 2 credits. Prerequisites: general microbiology, lectures and laboratory; introductory plant pathology. Not offered 2001–2002. S. V. Beer.
A consideration of the prokaryotes that cause disease in plants and examples of the diseases they cause. The course emphasizes properties of bacterial pathogens that affect disease, methods for manipulation of the pathogens, and recent developments in phytobacteriology. The current state of knowledge of important phytopathogenic

genera including their genetics and mechanisms of pathogenesis is reviewed. Laboratory practice in isolation, inoculation, identification, genetics, and physiology is included.]

PL PA 709 Phytomycology
Spring. 2 credits. For graduate students with a major or minor in plant pathology or mycology; others by permission. Prerequisites: PL PA 401 and 309 or equivalents, or permission of instructor. Lec, F 1:25–2:30; lab, 2:30–4:30. J. W. Lorbeer.
Provides basic information on the biology of plant pathogenic fungi with emphasis on the structure, ecology, genetics, life cycles, and disease cycles of representative genera and species.

PL PA 738 Filamentous Fungal Genomics and Development
Fall. 2 credits. Prerequisite: BIOGD 281 or equivalent. B. G. Turgeon.
Molecular genetic and genomic approaches to the study of fungal biology. Applications of contemporary methodology to genetic dissection of developmental processes, such as plant pathogenesis (including host and tissue specificity) and reproduction, both sexual and asexual, are described. Experimental evidence supporting various hypotheses to explain fungal pathogenicity is evaluated. Examples are chosen from investigations of model plant pathogenic fungi such as *Cochliobolus heterostrophus*, *Magnaporthe grisea*, and *Ustilago maydis* and from well known genetic models such as *Aspergillus nidulans* and *Neurospora crassa*.

[PL PA 739 Advanced Mycology
Spring. 4 credits. Prerequisites: PL PA 309 or equivalent, and permission of instructor. Not offered 2001–2002. 1 lecture; 2 labs TBA. K. T. Hodge.
Advanced-level topics in mycology, including ecology and systematics of selected fungal groups. One lecture per week introduces the week's topics; students gain hands-on experience working with and identifying fungi during two laboratory sessions. The course is aimed at students pursuing or preparing for graduate-level work in mycology.]

PL PA 788 Research in Molecular Plant Pathology
Fall and spring. 2, 4, or 6 credits. Prerequisite: permission of instructor before beginning research. S-U grades only. S. V. Beer.
Guided research experiences in laboratories addressing questions concerning the interaction of pathogens (bacteria, fungi, viruses) and plants at the molecular level. Intended for beginning graduate students with a concentration in Molecular Plant Pathology and sufficient theoretical background and practical laboratory experience. Students submit plans and reports on each research experience.

PL PA 797 Special Topics
Fall or spring. 1–5 credits. S-U grades optional.
An opportunity for independent study of a special topic.

PL PA 798 Graduate Teaching Experience
Fall or spring. 1–5 credits. S-U grades. Hours TBA. Staff.
Graduate teaching assistance in a mycology or plant pathology course by mutual agreement with the instructor. This experience may include, but is not limited to, preparing, assisting in, and teaching laboratories, preparing and delivering lectures, leading discussion sessions, and tutoring.

PL PA 800 Master's-Level Thesis Research
Fall or spring. Credit TBA. S-U grades optional. Prerequisite: permission of adviser. Graduate faculty.
For students working on a master's degree.

PL PA 900 Graduate-Level Thesis Research
Fall or spring. Credit TBA. S-U grades optional. Prerequisite: permission of adviser. Graduate faculty.
For students in a Ph.D. program who have not passed the "A" exam.

PL PA 901 Doctoral-Level Thesis Research
Fall or spring. Credit TBA. S-U grades optional. Prerequisite: permission of adviser. Graduate faculty.
For doctoral candidates who have passed the "A" exam.

POMOLOGY (FRUIT SCIENCE)

See Horticulture.

RURAL SOCIOLOGY

P. D. McMichael, chair; D. L. Brown, P. R. Eberts, P. Eloundou-Enyegue, S. Feldman, J. D. Francis, C. C. Geisler, P. K. Gellert, A. Gonzales, D. T. Gurak, T. A. Hirschl, T. A. Lyson, M. J. Pfeffer, J. M. Stycos, L. B. Williams

Note: class meeting times are accurate at the time of publication. If changes are necessary, the department will provide new information as soon as possible.

R SOC 100 Introduction to American Indian Studies (also AIS 100)
Fall. 3 credits. S-U optional. Enrollment limited to 550. W 7:30–10:30 P.M. R. W. Venables.
Slide lectures survey the rich cultures and complex histories of the Indian nations north of Mexico. Indian arts and philosophies are compared and contrasted with those of Europe, Africa, Asia, Canada, and the United States. The origins of today's major legal issues involving American Indians are also discussed. The course begins with a survey of Indian America before Columbus and ends at Wounded Knee in 1890, the event which marks the end of the conquest of Indian America. Guest lecturers, including American Indian leaders, provide additional perspectives.

R SOC 101 Introduction to Sociology
Fall, spring, or summer. 3 credits. Enrollment limited to 300 in the fall, 400 in the spring. Lecs, T R 10:10–11:00; sec, various times. Fall, T. Hirschl; spring, staff.
This course provides an introduction to theory and research in sociology. It demonstrates how the insights, theories, and methods of sociological analysis can be brought to bear on major issues of social life. A primary goal is to convey a sense of the manner in which sociologists formulate theories and how the collection and analysis of data are used to evaluate those theories. The course provides "hands-on" experience in analyzing sociological issues. Students undertake guided research exercises that involve using computers to analyze actual data. No prior background is presumed; necessary skills are covered in class and section meetings.

[R SOC 103 Self and Society (also SOC 103)
Fall. 3 credits. S-U optional. Not offered 2001—2002. Lec, T R 1:25–2:15. M. Macy.
An introduction to microsociology, focusing on social processes in small groups, including the family. Emphasis is on leadership, conformity, social influence, cooperation and competition, distributive justice, and micro analyses of interaction.]

R SOC 105 Economic Sociology (also SOC 105)
Fall. 3 credits. S-U optional. M W 1:25–2:15. Sec 1 F 12:20–1:10; sec 2 F 1:25–2:15. C. Leuenberger.
This course examines how sociologists understand the economy as a social phenomena. The focus is on classical and contemporary theorists as well as empirical studies in economic sociology. Students consider the impact of the dynamics of capitalism and globalization on social life and how the economic organization of society can be related to religion, culture, and concepts of leisure. Also investigated are areas in which people interact with the economy on a daily basis: in selling, shopping, and consuming.

R SOC 175 Indian America in the Twentieth Century (also AIS 175)
Spring. S-U option. Enrollment limited to 125. Lec, M W 11:15–12:05; sec, various times. B. Baker.
This course addresses major U.S. policies affecting American Indians in the twentieth century, and ways in which American Indians pursued strategies to sway the process of social change. American Indian political, economic, and cultural issues are examined through history, literature, music/art, and film/documentary. The approach of this course is interdisciplinary and an emphasis is placed on the study of American Indians as living cultures. Current trends are discussed, and the implications for American Indians in the twenty-first century are explored. Guest lecturers, including American Indian scholars, leaders, and activists, provide additional perspectives.

[R SOC 200 Social Problems (also SOC 200)
Fall. 3 credits. S-U grades optional. Enrollment limited to 100. T R 10:10–11:25. Not offered fall 2001. T. A. Hirschl.
This course investigates a variety of current social problems from a sociological perspective. The course begins with an overview of sociological theories that may account for social problems and identifies common as well as competing elements of these theories. The theoretical framework is then applied to analyze a variety of social problems, which may vary semester to semester. Examples of social problems are homelessness, teenage pregnancy, deindustrialization, and homicide, among others. Emphasis is given to how social problems are measured, and students are given an opportunity to test theories with data analysis.]

R SOC 201 Population Dynamics (also SOC 202)
Spring. 3 credits. S-U grades optional. Enrollment limited to 35. ALS students must register for this course as R SOC 201. T R 2:55–4:10. P. Eloundou-Enyegue.
This course provides an introduction to population studies. After reviewing basic concepts and demographic principles and techniques, the course focuses on how demographic processes (fertility, mortality, and migration) affect social and economic outcomes. Discussions cover special topics related to population growth and distribution, including mass education, marriage and family formation, labor force participation, inequality and poverty, women's status, resource allocation, and the environment.

R SOC 205 International Development (also SOC 206)
Spring. 3 credits. Enrollment limited to 74. M W F 10:10–11:00. Staff.
New questions concerning development models in the post-Cold War era are examined from a comparative and global perspective on North-South relations. While the focus is the "Third World," the issues confronting it are often global, even when they concern the most basic issue of food security. Using films and various theoretical perspectives, we examine Southern societies (economies, ecologies, class/gender relations) and the impact of global forces on Southern resources. Such forces include global food systems, new forms of export production, development agencies, multilateral institutions, local bureaucracies, transnational corporations, the debt crisis, and new technologies. Also examined, are the new social movements, such as environmentalism, feminism, and grassroots activism.

R SOC 206 Gender and Society (also WOMNS 206)
Spring. 3 credits. Enrollment limited to 100. Lecs, M W 11:15–12:05; sec, various times. B. Wejnert.
Course familiarizes students with origin of gender hierarchies, social and behavioral similarities/differences between females and males, and the degree that biological, psychoanalytic, psychological and sociological perspectives help to understand the differences. United States and cross-cultural comparisons of the consequences of gender inequality are a major focus of the course. Objectives are met through lectures, readings, films, participant observation, and personal experiences.

R SOC 207 Problems of Contemporary Society (also SOC 207)
Fall. 3 credits. S-U grades optional. Lec, M W F 1:15–2:15. D. Heckathorn.
This course examines contemporary social problems, with a focus on their sources in the organization of society. Modern societies are based on three fundamental types of institutions—social norms, hierarchies, and markets. Each is subject to distinctive types of failures resulting in problems that include poverty, prejudice and discrimination, intolerance and hate, alcohol and drug abuse, physical and mental illness, crime and delinquency, and urban problems. In analyzing these problems, the institutions through which they are created and perpetuated, and the forms of institutional change required to address them are emphasized.

R SOC 208 Technology and Society
Fall. 3 credits. Offered odd years. M W F 10:10–11:00. C. C. Geisler.
The relationship between technology and society is among the most pervasive concerns of our time. Ultimately, what makes a technology useful or "appropriate" is a sociological question. Lectures and readings review classical debates regarding technology and society. Herein, students compare high technologies and appropriate technologies, identify problems associated with technology transfer to other societies, and create a list of important criteria by which technologies are judged appropriate or inappropriate using numerous case studies.

R SOC 209 Social Inequality (also SOC 208)
Spring. 3 credits. S-U optional. T R 1:25–2:40. D. Grusky.
This course examines the nature and processes of social inequality in industrial societies. The principal focus is on the contemporary United States, with some comparisons to other industrial societies with different educational and class structures. Readings include theoretical and empirical materials on urban inequality and stratification along race, class, and gender lines. The course includes ethnographies of schools and workplaces as well as more quantitative research.

R SOC 213 Social Indicators, Data Management, and Analysis
Fall. 3 credits. Offered alternate years (complement of R SOC 214). T R 11:40–12:55. P. R. Eberts.
A survey of definitions of social indicators and general principles of social indicators research is illustrated from data on both developed and less-developed countries. Data management and analysis of measures of poverty, level of living, inequality, quality of life, and so on, based on census data, household surveys, and key-informant and other low-cost techniques, are examined using personal computers.

[R SOC 214 Research Methods for the Social Sciences
Fall. Offered even years (complement of R SOC 213). 3 credits. Enrollment limited to 25. T R 11:40–12:55. Not offered 2001–2002. L. B. Williams.
A number of approaches to conducting research in the social sciences will be presented. These include observation techniques, unstructured, semi-structured, and structured interviews, experiments, and focus groups. Some statistical techniques for data analysis are discussed. A background in elementary statistics is preferred although it is not required.]

R SOC 215 Organizations: An Introduction (also SOC 215)
Spring. 3 credits. S-U optional. Lec, T R 10:10–11:25. S. Han.
This is an introductory course in the study of organizations. Students start by taking a look at various examples of organizing, including: a street gang in a Boston neighborhood, a minority community, industrial corporations, modern universities, Silicon Valley and Route 128, and more. Hence, a sampler. These brief glimpses serve as exercises in looking behind and beyond diverse rhetoric for common patterns in organizational phenomena. The focus of the course is on research scholarship, not the training of managers. Nonetheless, the analytical skills students acquire are applicable to work in firms, government agencies, and nonprofit organizations.

R SOC 220 Sociology of Health of Latinos and Ethnic Minorities (also LSP 220)
Fall. 3 credits. S-U grades optional. Enrollment is limited to 15. T R 10:10–11:25. P. A. Parra.
Discusses the health status of minorities in the United States. This course explores intragroup diversity such as migration, economic status, and the influence of culture and the environment on health status and access to health care. Although special attention is given to Latino populations, discussion encompasses other minorities who face similar problems.

R SOC 261 Sociology of Sustainable Development
Fall. 3 credits. S-U grades optional. M W 2:55–4:10. L. Glenna.
This course is designed to offer a critical evaluation of sustainable development as concept and practice. Although scholars and practitioners now analyze and debate it, sustainable development originated more in practice than in theory. Powerful global organizations, governments, and local activists have adapted and adopted it since it was popularized in the 1987 Brundtland report, giving rise to more than 40 definitions by 1994. To determine the social usefulness of such a widely debated term, students examine its evolution from the original eighteenth-century concept of development into sustainable development in the field of natural resource management in the 1970s and into an environmental critique of economic growth, or market society, in the 1980s. Then students debate the salience of this concept by evaluating case studies in the United States and other parts of the world.

R SOC 301 Theories of Society (also SOC 375)
Spring. 3 credits. Prerequisites: Rural sociology or sociology course. S-U grades optional. Enrollment is limited to 30. M W F 11:15–12:05. P. K. Gellert.
An introduction to the "classical" sociological theorists (Marx, Weber, Durkheim) of the late nineteenth and early twentieth century, as well as "erased" and missing sociological voices of the period (such as C. Perkins Gilman, W.E.B. DuBois). The course addresses the dramatic social upheavals including the fall of the 'old order,' industrialization, capitalism, and rise of bureaucracy to which these thinkers reacted and the inspiring (and conflicting) visions for the future which they offered. The intellectual history, the influence of the theorists on subsequent sociology, and the potential for relevance to contemporary society are emphasized.

R SOC 302 Evaluating Statistical Evidence (also SOC 301)
Fall. 3 credits. S-U optional. Lec, M W 10:10–11:00. Staff.
A first course in statistical evidence in the social sciences, with emphasis on statistical inference and multiple regression models. Theory is supplemented with numerous applications.

R SOC 305 Education, Inequality and Development
Spring. 3 credits. Letter grade. Prerequisite: introductory social science course or permission of instructor. T R 1:25–2:40. P. Eloundou-Enyegue.

Improvements in formal school systems are often advocated as solutions for a variety of economic, health, political, and environmental problems in non-industrial nations. Commonly suggested improvements include: raising enrollments, reducing schooling inequalities, improving the quality and relevance of instruction, and adjusting the private returns to schooling. This course offers a critical assessment of human capital approaches to development. The course examines how improvements in mass schooling can be achieved in poor countries and how much such improvements are likely to boost these countries' economic prospects. Specific reviews focus on: current trends in mass schooling across the developing world; patterns of schooling inequalities; policy tools for evaluating the impact of alternative education policies; and the theory and evidence on the benefits of mass schooling on development indicators.

R SOC 311 Social Movements
Spring. 3 credits. T R 11:40–12:55. A. Gonzales.
Social movements are collective efforts by relatively powerless groups of people to change society. Social movements have occurred throughout history and the world, even under the most repressive regimes. This course examines the origins and impact of contemporary social movements on politics and policy in the United States and elsewhere. After reviewing the major theoretical perspectives on social movements, focus is on three questions: Under what circumstances do movements emerge? How do movements internally organize and choose political tactics and strategies to achieve their goals? How have these movements changed history, identities, society, and politics? The course explores these questions through an examination of Indigenous movements for social justice, civil rights, environmental protection, and trial sovereignty.

R SOC 318 Ethnohistory of the Northern Iroquois (also AIS 318)
Spring. 3 credits. S-U grades optional. Enrollment limited to 20. T 1:25–4:25 R. W. Venables.
The development of Iroquois (Houdenosaunee) history and culture is traced to the present day.

R SOC 324 Environment and Society (also S&TS 324 and SOC 324)
Spring or summer. 3 credits. Enrollment limited to 100. M W F 1:25–2:15. L. Glenna.
The main objective of the course is to develop a critical understanding of the dominant trends in modern U.S. environmental thought like preservationism, conservationism, deep ecology, ecofeminism, social ecology, NIMBYism, risk assessment, and environmental equity. Another objective is to familiarize students with some major contemporary substantive environmental problems and policies. These topics include air and water quality, public lands management, biodiversity, deforestation, climate change, and ozone depletion. A sociological framework is applied to evaluate interrelationships of substantive and philosophical/theoretical issues.

R SOC 325 Indigenous People and Globalization
Fall. 3 credits. Prerequisites: introductory social science course or permission of instructor. Letter grade. T R 2:55–4:10. A. Gonzales.
This course examines issues of globalization and how they affect indigenous people in the Americas. The processes of globalization, under the auspices of the World Trade Organization and regional economic agreements such as the North American Free Trade Agreement (NAFTA), have profound social, cultural and economic impacts upon indigenous peoples. At issue are the lands, resources, traditional knowledge, cultural property, and tribal sovereignty of indigenous peoples. This course examines issues such as the effect of NAFTA on the Indian people of Mexico and Central America; issues of cultural 'property' such as songs and stories of native artists; intellectual property such as plant medicines; the question of treaties and water rights; and whether and to what extent civil society can truly include and address the interests of indigenous peoples.

R SOC 331 Demographic Analysis in Business and Government (also AEM [ARME] 416)
Fall. 3 credits. Prerequisite: AEM (ARME) 210 or equivalent. Enrollment limited to 50 students (15 R SOC students, 35 AEM (ARME) students). Lec, M W F 1:25–2:15. W. Brown.
An overview of the way demographic analysis is used in business and government. Through the use of case study and problem solving methods of learning, students come to understand how demographic concepts, methods, and data are used by demographers to solve problems in business and government. The course is designed for upper-level undergraduates from a variety of academic disciplines and career orientations. Students work on problems drawn from consumer marketing, education, housing and real estate development, human resources, and health services.

R SOC 333 Genomics and Society
Fall. 3 credits. T R 1:25–2:40. L. Glenna.
The implications of genomics for society are far-reaching and controversial. In this course, a sociological perspective is deployed to examine and situate the debate by examing proponents' and opponents' assumptions about science and society. Special attention is given to the social origins and goals of agricultural and food biotechnologies, questions of social and environmental risk and reward, its relationship to previous trends in agricultural and food technologies, and the social forces and conditions that put biotechnology on the research and commercial agenda at this time. Placing the debate in social context promotes understanding and constructive dialogue regarding an important social issue.

R SOC 336 Rural Areas in Metropolitan Society
Spring. 3 credits. S-U grades optional. Prerequisite: a social science course. T R 11:40–12:55. Offered alternate years. D. L. Brown.
This course analyzes the changing structure and role of small towns and rural areas in developed nations. The focus is on adaptation of rural communities and populations to major trends including increased societal differentiation and complexity, increased societal interdependence, and rapid social, economic, technological, and ecological change. Alternative policies to ameliorate rural problems and/or enhance rural contributions to national development are considered. Students participate in group research projects in rural communities.

R SOC 340 Sociology of Food Systems
Spring. Enrollment limited to 25 students. 3 credits. S-U grades optional. T R 1:25–2:40. G. W. Gillespie.
Our changing food and agricultural systems are examined sociologically, with attention to how these reflect the social organization of an increasingly global society. What are the major trends? What drives them? What do these trends imply for people, communities, and the environment? What are the social, human health, and environmental issues? What might be better alternatives and what strategies of development might achieve them? This course addresses such questions.

[R SOC 360 Sociology of American Indians (also AIS 361)
Spring. 3 credits. S-U option. Enrollment limited to 20. Prerequisite: RSOC/SOC 101, AIS 100 or AIS 175, or approval of the instructor. Enrollment limited to 20. W 2:30–4:25. Not offered spring 2002.
This course is designed to emphasize the role of theory and research in our understanding of American Indians. Towards that end, the relationship between the nation-state and indigenous populations is emphasized. Students are exposed to the following theoretical perspectives: world systems and dependency, internal colonialism, social disintegration, the social construction of reality, political mobilization, and ethnic reorganization. The course is also historical and comparative, as students study different Indian tribes located in the United States and Canada.]

R SOC 367 American Indian Politics and Policy (also AIS 367)
Fall. 3 credits. S-U option. Enrollment limited to 20. T R 2:55–4:10. B. Baker.
This course addresses the Constitutional basis of the Federal-Indian relationship through an examination of treaties, Supreme Court decisions, and congressional law/policy. The effects of European and American forms of governance on traditional American Indian political structures are detailed and contrasted with contemporary tribal governments and political organizations. Issues relating to sovereignty and self-governance with respect to American Indian tribal governments are addressed relative to state and federal governments.

R SOC 370 Comparative Issues in Social Stratification (also SOC 371)
Fall. 3 credits. Prerequisite: an introductory social science course. T R 1:25–2:40 or T R 8:40–9:55 (depending on professor). T. A. Lyson or S. Feldman.
This course reviews both classical and contemporary issues in the comparative social stratification literature. Particular attention is given to the changing configurations of different labor markets, debates on the meaning of new economic constituencies, and the role of gender, race, ethnicity, and sexuality in assessing the patterns, meaning, and experiences of inequality. Throughout the course special attention is given to the

importance of understanding how questions of measurement are constructed and employed in understanding social inequality.

R SOC 380 Independent Honors Research in Social Science
Fall and spring. 1–6 credits. Limited to students who have met the requirements for the honors program. A maximum of 6 credits may be earned in the honors program. Staff.
Students should select a faculty adviser and begin proposal development during the junior year. Students must submit written proposals by the third week of the semester of their senior year to the departmental honors committee representative.

[R SOC 418 Population Policy (also B&SOC 414)
Spring. 3 credits. Prerequisite: R SOC 201 or permission of instructor. Enrollment limited to 15. T R 10:10–11:25. Offered alternate years. Not offered 2002. Staff.
The ways in which societies try to affect demographic trends. Special focus is on government policies and programs to reduce fertility.]

R SOC 430/629 Migration and Population Redistribution
Spring. 3 credits. Prerequisite: a social science course or permission of instructor. T R 8:40–9:55. Offered alternate years. D. L. Brown.
This course analyzes the determinants and consequences of internal migration in urban and rural areas of developed and developing nations. Economic and demographic interrelationships are emphasized as are implications of changes in local and regional population size and composition for labor supply, the demand for goods and services, and infrastructure. Public policy implications of the inter-relations are investigated. Techniques and measurement issues associated with the analysis of migration and population distribution are discussed. For 629, graduate students also meet with the instructor every other week to discuss graduate readings and topics relevant to their papers.

[R SOC 431/631 Comparative Ethnic Stratification: Demographic Perspectives
Spring. 3 credits. S-U grades optional. Prerequisite: Intro to Sociology or permission of instructor. T R 11:40–12:55. Not offered 2002. D. Gurak.
A comparative examination of ethnic stratification and mobility that focuses principally on dimensions of social groups that can be empirically measured using readily available demographic sources. These include residential segregation, occupational status and mobility, marriage and family formation patterns, health and mortality, family structure, fertility, and intermarriage. The role of migration in shaping ethnic stratification systems is also examined. About half of the course examines the U.S. situation. Other societies receiving significant attention include India, Brazil, Nigeria, and several European societies. For 631, graduate students will also meet with the instructor every other week to discuss graduate readings and topics relevant to their papers.]

[R SOC 437 Aging and Aging Social Policy in the 1990s
Fall. 3 credits. Prerequisite: R SOC 101 or its equivalent. Enrollment limited to 30. T R 11:40–12:55. Not offered 2001–2002. Staff.
An analysis of the "graying" of America and the responses of the public and private sectors to this demographic revolution. Examines the interplay between basic and applied knowledge in social gerontology. Explores the formal and informal networks of services, in both rural and urban environments, that help maintain independent living arrangements for the elderly.]

R SOC 438/638 Population and Development
Fall. 3 credits. S-U grades optional. Prerequisite: permission of instructor. T R 11:40–12:55. D. Gurak.
Examines major historical and recent demographic transitions in mortality, fertility, age structure, and composition and explore the relationships between these transitions and the social, or economic, and cultural changes being experienced by diverse societies prior to, during, and following the onset and conclusions of the demographic shifts. Case studies from diverse historical periods and geographic locations are used. Graduate students also meet with the instructor every other week to discuss graduate readings and topics relevant to their papers.

[R SOC 440 The Social Impact of Resource Development (also AIS 440)
Spring. 3 credits. S-U grades optional. Offered alternate years. Not offered 2001–2002. C. C. Geisler.
Social impact assessment (SIA) is a method of anticipating unwanted side-effects of projects, policies, and new technologies before they happen and a decision tool for mitigation. The seminar explores SIA applications in different parts of the world and pays particular attention to impacts on native and indigenous peoples. Students learn practical SIA skills and related theoretical/conceptual debates.]

R SOC 442 American Indian Philosophies: Selected Topics (also AIS 442)
Spring. 3 credits. S-U grades optional. Prerequisite: permission of instructor. Enrollment limited to 15. R 1:25–4:25. R. W. Venables.
This course provides an opportunity for students to read and discuss a wide range of American Indian philosophies.

R SOC 494 Special Topics in Rural Sociology
Fall or spring. 4 credits maximum. S-U grades optional.
The department teaches "trial" courses under this number. Offerings vary by semester, and are advertised by the department before the semester starts. Courses offered under the number will be approved by the department curriculum committee, and the same course is not offered more than twice under this number.

R SOC 495/695 Population and Development in Sub-Saharan Africa
Fall. 3 credits. S-U grades optional. Prerequisite: permission of instructor. T R 2:55–4:10. P. Eloundou-Enyegue.
This course examines recent trends in population, the economy and environment in sub-Saharan Africa. After reviewing these individual trends, the course examines possible linkages among these three processes. Specific discussions examine the theory and evidence on the effects of rapid population growth on the economy, mass schooling, health, gender and community structures, sustainable agriculture, and inequality. Graduate students are assigned additional reading and writing and meet bi-weekly in a seminar format.

R SOC 497 Independent Study in Rural Sociology
Fall or spring. 3 credits variable (may be repeated for credit). Students must register with an Independent Study form (available at 140 Roberts Hall). S-U grades optional.
Informal study may include a reading course, research experience, or public service experience.

R SOC 560 Managing Local Environmental Systems: Social Perspectives and Research Bases
Fall. 3 credits. S-U optional. Enrollment limited to 15. W 1:25–4:25. Staff.
Course is for students with diverse backgrounds: undergrads, grads, people in professional careers, others with interest in environmental issue identification, resolution, and management. Course discussions include ecological, social, economic, and local government perspectives. Via lab exercises throughout the semester, students have opportunities to apply the concepts and principles of these perspectives to analysis of specific local environmental management problems. Readings, lectures, and a course project are mandatory.

R SOC 599 M.P.S. Project
Fall and spring. 1–6 credits. S-U optional. Lec: TBA. Graduate faculty.
For students admitted specifically to a MPS program.

R SOC 601 Theoretical and Methodological Approaches to Community and Rural Development
Fall. 3 credits. Letter grade only. Prerequisite: graduate student. Lec, W 7:30–10:00 P.M. P. R. Eberts.
A survey of three general approaches for conducting analysis and practice in community and rural development. These approaches include examinations of: (1) community structural changes and policymaking; (2) participatory processes for generating community development; and (3) planning strategies as mechanisms for creating community development opportunities.

R SOC 602 Community Development Seminar
Spring. 1 credit. Prerequisite: R SOC 601. W 7:30–10 P.M. (Meets tri-weekly.) P. R. Eberts.
A participatory seminar for feedback, collective learning, and guidance as M.P.S. students apply community and rural development theory and methods in thesis project work with local and regional communities.

R SOC 603 Classical Sociological Theory
Fall. 4 credits. S-U grades optional. Prerequisites: open to graduate students only. T R 2:55–4:10. M. J. Pfeffer.
Students review the main streams of classical sociological thought, focusing on the work of Weber, Durkheim, Marx, and Simmel. Course materials include original texts and secondary literature, used to examine the concepts,

methods, and explanation in classical sociological thought. Important objectives of the course are to identify the philosophical and conceptual core of the discipline and to critically evaluate the relevance of the classical theories to contemporary social change and development.

R SOC 606 Sociological Theories of Development
Spring. 3 credits. T 2:30–5:30. P. K. Gellert.
This course is a critical examination of a historical range of theories and research in the sociology of development from the post-war period through the present. Major topics include modernization theory, dependency theory, world-system theory, the developmental state, global commodity chains, and globalization. Throughout the course, the concept of development itself is questioned and critiqued both theoretically and in terms of practical challenges from environmental, indigenous and other social movements.

[R SOC 607 Sociology of Natural Resources and Development
Fall. 3 credits. S-U optional. Not offered 2001–2002. R 1:25–4:25. P. K. Gellert.
Building on theories in the sociology of development, this seminar examines the role of natural resource extraction, processing, and exports to global markets in the developmental trajectories of nations in Asia, Africa, and Latin America. Engages students in both theoretical debates and practical implications of resource access, control, and conflict amongst various social actors ('stakeholders'). Detailed historical cases are examined, primarily from Southeast Asia (Indonesia, Malaysia, Philippines).]

R SOC 608 Demographic Techniques (also PAM 606)
Fall. 3 credits. Prerequisite: multivariate statistics or permission of instructor. S-U grades optional. T R 2:55–4:10. D. Gurak.
This course provides an introduction to the methods, measures, and data used in the analysis of human populations. Topics include demographic rates, life-table analysis, cohort vs. period analysis, sources and quality of demographic data, population estimation and projection, and stable population models.

R SOC 612 Population and Development in Asia (also WMNS 612)
Spring. 3 credits. Offered odd years. W 10:10–1:10. L. B. Williams.
This graduate seminar considers issues surrounding population and development in Asia. Case studies pertaining to Southeast Asia are highlighted. The linkages between population and development are highlighted and both are considered from a historical perspective. Recent social, economic, and demographic changes in the region are considered in depth. Evolving gender roles in the family, labor force, and broader social context are also examined.

[R SOC 618 Research Design I
Fall. 4 credits. Prerequisite: a statistics course. T R 12:20–2:15. Not offered fall 2001. J. D. Francis.
First of a two-semester sequence (may be taken individually) in introductory graduate methods. Discusses problems of measurement, the design of instruments, and problems of reliability and validity. Common forms of measuring instruments are discussed. Concludes with an introduction to factor analysis. Students apply principles to development of several common types of scales. Computers are used extensively.]

[R SOC 619 Research Design II
Spring. 4 credits. Prerequisite: an introductory methods course and a statistics course. T R 12:20–2:15. Not offered spring 2002. J. D. Francis.
The second part of the two-semester sequence in introductory graduate methods, with emphasis on an intermediate-level treatment of the following topics: regression, analysis of variance, analysis of covariance. Special attention is given to use of categorical variables in regression. Students develop and examine several analytical models using actual data to familiarize themselves with data handling and processing. Includes extensive use of computers.]

R SOC 620 Sociology of the Community
Fall. 3 credits. R 1:25–4:25. D. Brown.
This graduate seminar critically analyzes the intellectual core of community sociology, and its theoretical development over time. "Community," as a concept, is often reified and rarely critically examined, hence the course begins by clarifying the various ways in which "community" has been conceptualized and operationalized by sociologists. The course provides students with both a grounded conceptual foundation and an overview of multiple strategies for conducting research on community structure and change in the United States and internationally. The course includes a critical examination of the forms and shapes sociological research on the community assumes. A case study approach is used to examine the assumptions driving the methods and analysis of both contemporary and historical research.

[R SOC 621 Foundations of Environmental Sociology
Fall. 3 credits. Open to graduate students only. S-U optional. Enrollment limited to 20. W 10:10–12:35. Offered even years. Not offered 2001–2002. L. Glenna.
Foundations of Environmental Sociology provides graduate students with a broad survey of the literature in this disciplinary specialty area. Students review the history of thought in environmental sociology as well as key literature in the various substantive foci of this specialty. The principle objective of this course is to provide graduate students specializing in environmental sociology with a firm grasp of the content, controversies, and trends in the area. Sessions are conducted in a seminar style, and discussions are focused on close review of assigned readings.]

R SOC 625 State, Economy, and Society
Spring. 3 credits. Enrollment limited to 25. W 1:25–4:25. Offered even years. P. D. McMichael.
Reviews major issues concerning the relations between political and economic institutions and the role of states, markets, firms, social movements, and cultural institutions in the process of social change. Theoretical perspectives are drawn from classical and modern social theory, including the application of comparative and world/historical methodologies.

R SOC 630 Field Research Methods and Strategies
Fall. 3 credits. Enrollment limited to 20. W 10:10–1:10. Offered odd years. L. B. Williams.
This course covers a variety of methods: focus groups, in-depth interviews, participant observation, archival research, and structured surveys, among others. The importance of matching research questions with appropriate field methodologies and the strengths and weaknesses of various strategies of field research are assessed. Practical experience with a number of methodologies is offered. Ethical issues involved in fieldwork are highlighted.

[R SOC 640 Community and Changing Property Institutions
Fall. 3 credits. R 1:25–4:25. Offered even years. Not offered 2001–2002. C. C. Geisler.
The seminar acquaints students with the evolution of property rights, from antiquity to the present, and features a number of property debates (the biological basis of ownership; private versus public ownership; property and value; the so-called "tragedy of the commons"; the "new" property). Readings explore land use regulation and property rights, common property issues, opposing land ethics, and new property forms in the future.]

[R SOC 641 Politics and Economics of Rural and Regional Development
Fall. 3 credits. Limited to upperclass or graduate students. S-U grades optional. M 12:20–2:50. Offered alternate years. Not offered 2001–2002. T. A. Lyson.
A survey of social, political, and economic factors in local and regional development. Theories of community and regional development and underdevelopment are explored. Neoclassical, Marxist, and civil society theories are examined within local and global contexts.]

[R SOC 643 Land Reform Old and New
Spring. 3 credits. S-U grades optional. R 1:25–4:25. Not offered spring 2002; next offered spring 2003. C. C. Geisler.
Land reform continues to be a major cornerstone of development planning. Currently the number of landless and near-landless in the Third World will approach one billion. Though land reform is a principal source of hope for the landless, its meanings are many and its models are controversial. The seminar acquaints students with land reform in antiquity as well as in contemporary settings (among others, Japan, the Philippines, Israel, India, Brazil, Mexico, Russia, and the United States). Perennial issues of equity, efficiency, and sustainability are discussed in each of these case study areas.]

[R SOC 645 Rural Economy and Society
Spring. 3 credits. W 1:25–4:25. Offered alternate years. Not offered 2001–2002. Staff.
The structure and dynamics of rural communities are examined in a comparative historical framework focusing on continuities and divergences among imperialist and post colonial settings. Major topics include classical theories of rural social organization and their retheorization in contemporary peasant studies and agrarian political economy literatures, theorizations of locality, rurality and spatial complexity within the world economy, and critical issues framing the

relationship between political and labor market restructuring and petty commodity and household production systems.]

[R SOC 655 Advanced Techniques of Demographic Analysis
Spring. 3 credits. Prerequisites: CEH 606, graduate standing or permission of instructor. Enrollment limited to 25. M 7:30–10:30 P.M. Offered alternate years. Not offered 2001–2002. D. T. Gurak.
An examination of analytical techniques that assumes a basic knowledge of demographic data and research methodology. Life tables, demographic estimates with incomplete data, survey techniques to supplement inadequate vital registration systems, data management, multi-level models, and other multivariate procedures are among the topics covered.]

[R SOC 661 Sustainable Agriculture and Development
Spring. 3 credits. S-U grades optional. Prerequisites: graduate standing or instructor's permission. Offered alternate years. M 10:10–12:35. Not offered 2001–2002. T. A. Lyson.
This course examines the relationship between local agriculture and development as these are embedded in a globalizing economy. Topics include an examination of the social scientific theoretical underpinnings of conventional agriculture, the social origins of sustainable agriculture, environmental and community sustainability, agricultural diversification strategies, community agriculture development, and the political and policy contexts of more sustainable agricultural systems.]

R SOC 666 Genomics, Agriculture, Food Systems and Development
Spring. W 10:10–1:10. T. A. Lyson.
This seminar examines many of the emerging social, economic, political, cultural and demographic aspects of agricultural and food related genomics. Advanced biotechnologies have the potential to revolutionize many aspects of society—from how, where, when, and by whom food is produced, processed and consumed, to how dietary changes may be used to treat illness and disease. The consequences of the genomics revolution ' development processes in both advanced industrial as well as the developing world are considered.

R SOC 671 Epistemological Challenges to Social Science Paradigms: A Feminist Inquiry (also WOMNS 671)
Fall. 3 credits. W 1:25–4:25. Offered alternate years. S. Feldman.
This course reviews and analyze contemporary themes in feminist epistemological critiques of sociological methods and knowledge systems. It identifies mainstream explanations within the social sciences, introduces early feminist challenges to androcentric paradigms, and explores philosophical assumptions of postmodern and poststructural analyses. Substantive foci assess various approaches to field, archival, and survey research, and the theoretical presuppositions of approaches from rationalism to postpositivism. Also addressed are the linkages between theory and questions of political practice, individualism, and autonomy.

[R SOC 675 Global Patterns of International Migration
Fall. 3 credits. Enrollment limited to 20. M 7:30–10:30 P.M. Offered alternate years. Not offered 2001–2002. Staff.
International migration to the United States and other countries has increased in recent decades. What accounts for that trend in an era when large-scale international migration is supposed to have ended and what are the implications of immigration for receiving countries? Theories and research on these issues are examined in the course from a comparative and interdisciplinary perspective. Several migration systems are examined, including those of North America and the European Community. Policies shaping immigration are also reviewed.]

R SOC 694 Special Topics in Rural Sociology
Fall or spring. 4 credits maximum. S-U grades optional.
The department teaches "trial" courses under this number. Offerings vary by semester, and are advertised by the department before the semester starts. Courses offered under the number will be approved by the department curriculum committee, and the same course is not offered more than twice under this number.

[R SOC 715 Comparative Research Methods
Spring. 3 credits. M 12:20–2:50. Offered odd years. Not offered 2001–2002. T. A. Lyson.
This seminar focuses on the comparative method in the social sciences. The logic of comparative inquiry forms the substantive base of the course. Topics include cross-national and cross-regional research design and an analysis of the comparative case study approach. Illustrations of the comparative research approach cover a range of data types and problems.]

R SOC 718 Multidimensional Measurement and Classification
Fall. 4 credits. Prerequisite: previous course work in scaling and statistics. T R 12:20–2:15. Offered odd years. J. D. Francis.
An advanced course in measurement and scaling, building from work by Thurstone, Guttman, and Coombs to multidimensional measurements. Topics include philosophy of factor analysis, factor-analysis models, factoring design, factoring techniques, and comparison with factor-analysis models. Cluster analysis and multidimensional scaling are the other major techniques discussed. As matrix algebra is an integral part of these procedures, class time is devoted to this topic. Computers are used to analyze fit to models.

R SOC 719 Logistic and Log Linear Models
Spring. 4 credits. Prerequisites: two courses in statistics and one in methods. T R 12:20–2:15. Offered even years. J. D. Francis.
The first part of the course reviews multiple regression theory and procedures, after which extensions of these models to categorical data are discussed. Consideration is given to violations of assumptions and their effects. Then more advanced regression concepts and estimation techniques are discussed. The main focus of the course is on logit and log linear models. Computerized labs are an integral part of the course.

R SOC 725 The Sociology of "Third World" States
Fall. 3 credits. W 1:25–4:25. Offered alternate years. S. Feldman.
This course examines how processes of political and economic restructuring have reshaped state capacities and processes of state formation. Particular attention is paid to questions of class formation, corporatist alliances, transnational interests, and alternative development strategies with the emergence of austerity, privatization, and trade liberalization and its neoliberalist ideology. Critical to this discussion are the contours of authoritarianism, nationalism, communalism, and fundamentalism as these reconfigure national and regional alliances and practices and shape interpretations of current processes of resistance, change, and terms of intervention and exchange.

[R SOC 730 Sociology of Global Change
Spring. 3 credits. S-U grades optional. Enrollment limited to 20. W 1:25–4:25. Offered odd years. Not offered 2001–2002. P. D. McMichael.
Analyses of social change and development are increasingly sensitive to global context. They include the sociology of the world economy as a multi-layered entity anchored in an evolving international division of labor and the system of nation states, and the sociology of transnational political, economic, and cultural processes (e.g., food regimes, commodity chains, diasporas and transnational identities, the new regionalism, and transnational social movements). The seminar examines the substantive and methodological questions generated by research on these global processes, including questions of relevant units of analysis, situating global process in local events and subjectivities and vice versa, and examining the ways in which national structures and cultures interact with global structures and cultures.]

R SOC 791 Teaching Experience
Fall or spring. 1–3 credits. Limited to graduate students. S-U grades only. Graduate faculty.
Participation in the ongoing teaching program of the department.

R SOC 800 Master's-Level Thesis Research
Fall or spring. Credit TBA. Prerequisite: permission of instructor. S-U grades optional. Graduate faculty.
For students admitted specifically to a Master's program.

R SOC 872 Development Sociology
Limited to master's and doctoral degree candidates with permission of the graduate field member concerned. S-U grades optional. Graduate faculty.

R SOC 900 Graduate-Level Thesis Research
Fall or spring. Credit TBA. Prerequisite: permission of instructor. S-U grades optional. Graduate faculty.
For students in a Ph.D. program **only before** the "A" exam has been passed.

R SOC 901 Doctoral-Level Thesis Research
Fall or spring. Credit TBA. Prerequisite: permission of instructor. S-U grades optional. Graduate faculty.
For students admitted to candidacy **after** the "A" exam has been passed.

Related Courses in Other Departments

(Others may be added)

Population Dynamics (SOC 205)

Gender Relations, Gender Ideologies, and Social Change (WMNS 524)

Summer Session Courses

Introduction to Sociology (6-week session)

Environment and Society (3-week session)

Sociology of Health and Human Behavior (3-week session)

Soil, Crop, and Atmospheric Sciences (SCAS) courses are located in the Departments of Crop and Soil Sciences (CSS) and Earth and Atmospheric Sciences (EAS) section of this catalog.

VEGETABLE CROPS

See Horticulture.

FACULTY ROSTER

Abawi, George S., Ph.D., Cornell U. Prof., Plant Pathology (Geneva)
Acree, Terry E., Ph.D., Cornell U. Prof., Food Science, and Technology (Geneva)
Adleman, Marvin I., M. L. A., Harvard U. Prof., Landscape Architecture
Agnello, Arthur M., Ph.D., North Carolina State U. Assoc. Prof., Entomology (Geneva)
Ahner, Beth A., Ph.D., Massachusetts Institute of Technology. Asst. Prof., Agricultural and Biological Engineering
Albright, Louis D., Ph.D., Cornell U. Prof., Agricultural and Biological Engineering
Aldwinckle, Herbert S., Ph.D., U. of London (England). Prof., Plant Pathology (Geneva)
Allee, David J., Ph.D., Cornell U. Prof., Applied Economics and Management
Altman, Naomi S., Ph.D., Stanford U. Assoc. Prof., Biometrics
Andersen, Robert L., Ph.D., U. of Minnesota. Prof., Horticultural Sciences (Geneva)
Anderson, Bruce L., Ph.D., U. of California at Berkeley. Assoc. Prof., Applied Economics and Management
Aneshansley, Daniel J., Ph.D., Cornell U. Assoc. Prof., Agricultural and Biological Engineering
Arneson, Phil A., Ph.D., U. of Wisconsin. Assoc. Prof., Plant Pathology
Austic, Richard E., Ph.D., U. of California at Davis. Prof., Animal Science
Baer, Richard A., Ph.D., Harvard U. Prof., Natural Resources
Baeumner, Antje J., Ph.D., U. Stuttgart. Asst. Prof., Agricultural and Biological Engineering
Bain, Mark B., Ph.D., U. of Massachusetts. Assoc. Prof., Natural Resources
Barbano, David M., Ph.D., Cornell U. Prof., Food Science
Barrett, Christopher B., Ph.D., U. of Wisconsin. Assoc. Prof., Applied Economics and Management
Bartsch, James A., Ph.D., Purdue U. Assoc. Prof., Agricultural and Biological Engineering
Bassuk, Nina L. Ph.D., U. of London (England). Prof., Horticulture
Batt, Carl A., Ph.D., Rutgers U. Prof., Food Science
Baugher, Sherene, Ph.D., SUNY Stonybrook. Assoc. Prof., Landscape Architecture
Bauman, Dale E., Ph.D., U. of Illinois. Prof., Animal Science
Baveye, Philippe C., Ph.D., U. of California at Riverside. Assoc. Prof., Crop and Soil Sciences
Beer, Steven V., Ph.D., U. of California at Davis. Assoc. Prof., Plant Pathology
Bell, Alan W., Ph.D., U. of Glasgow (Scotland). Prof., Animal Science
Bellinder, Robin R., Ph.D., Virginia Polytechnic Inst. and State U. Prof., Horticulture
Bergstrom, Gary C., Ph.D., U. of Kentucky. Prof., Plant Pathology
Bills, Nelson L., Ph.D., Washington State U. Prof., Applied Economics and Management
Bjorkman, Thomas N., Ph.D., Cornell U. Assoc. Prof., Horticultural Sciences (Geneva)
Blake, Robert W., Ph.D., North Carolina State U. Prof., Animal Science
Blossey, Bernd, Ph.D., Christian-Albrechts U., Germany. Asst. Prof., Natural Resources
Boisclair, Yves R., Ph.D., Cornell U. Assoc. Prof., Animal Science
Boisvert, Richard N., Ph.D., U. of Minnesota. Prof., Applied Economics and Management
Boor, Kathryn J., Ph.D., U. of California at Davis. Assoc. Prof., Food Science
Brady, John W., Jr., Ph.D., SUNY at Stonybrook. Prof., Food Science
Brown, Dan L., Ph.D., Cornell U. Assoc. Prof., Animal Science
Brown, David L., Ph.D., U. of Wisconsin. Professor, Rural Sociology
Brown, Susan K., Ph.D., U. of California at Davis. Assoc. Prof., Horticultural Sciences (Geneva)
Bryant, Ray B., Ph.D., Purdue U. Prof., Crop and Soil Sciences
Burr, Thomas J., Ph.D., U. of California at Berkeley. Prof., Plant Pathology (Geneva)
Butler, Walter R., Ph.D., Purdue U. Prof., Animal Science
Calderone, Nicholas W., Ph.D., Ohio State U. Asst. Prof., Entomology
Campo, Michelle L., Ph.D., Michigan State U. Asst. Prof., Communication
Carlsen, William S., Ph.D., Stanford U. Assoc. Prof., Education
Castillo-Chavez, Carlos, Ph.D., U. of Wisconsin. Prof., Biometrics
Chan, Alice P., Ph.D., Michigan State U. Asst. Prof., Communication
Chapman, Lewis D., Ph.D., U. of California at Berkeley. Prof., Applied Economics and Management
Chase, Larry E., Ph.D., Pennsylvania State U. Assoc. Prof., Animal Science
Chau, Ho Yan, Ph.D., John Hopkins U. Asst. Prof., Applied Economics and Management
Cheng, Lailiang, Ph.D., Oregon State U. Asst. Prof., Horticulture
Cherney, Jerome H., Ph.D., U. of Minnesota. Prof., Crop and Soil Sciences
Christy, Ralph D., Ph.D., Michigan State U. Prof., Applied Economics and Management
Coffman, W. Ronnie, Ph.D., Cornell U. Prof., Plant Breeding
Collmer, Alan R., Ph.D., Cornell U. Prof., Plant Pathology
Colucci, Stephen J., Ph.D., SUNY. Prof., Earth and Atmospheric Sciences
Conrad, Jon M., Ph.D., U. of Wisconsin. Prof., Applied Economics and Management
Conroy, Carol A., Ph.D., Pennsylvania State U. Asst. Prof., Education
Contreras, Martha, Ph.D., U. of California at Riverside. Asst. Prof., Biometrics
Cooch, Evan G., Ph.D., Queen's U. Asst. Prof., Natural Resources
Cook, Kerry H., Ph.D., North Carolina State U. Assoc. Prof., Earth and Atmospheric Sciences
Cooke, J. Robert, Ph.D., North Carolina State U. Prof., Agricultural and Biological Engineering
Cox, William J., Ph.D., Oregon State U. Prof., Crop and Soil Sciences
Currie, W. Bruce, Ph.D., Macquarie U. (Australia) Prof., Animal Science
Curtis, Paul D., Ph.D., North Carolina State U. Asst. Prof., Natural Resources
Danforth, Bryan N., Ph.D., U. of Kansas. Asst. Prof., Entomology
Datta, Ashim K., Ph.D., U. of Florida. Prof., Agricultural and Biological Engineering
Decker, Daniel J., Ph.D., Cornell U. Prof., Natural Resources
DeGloria, Stephen D., Ph.D., U. of California at Berkeley. Assoc. Prof., Crop and Soil Sciences
de Gorter, Harry, Ph.D., U. of California at Berkeley. Assoc. Prof., Applied Economics and Management
DeJong, Walter S., Ph.D., U. of Wisconsin. Asst. Prof., Plant Pathology
Delaney, Terrence, Ph.D., U. of Washington. Asst. Prof., Plant Pathology
Dillard, Helene R., Ph.D., U. of California at Davis. Prof., Plant Pathology (Geneva)
DiTommaso, Antonio, Ph.D., McGill U. Asst. Prof., Crop and Soil Sciences
Dunn, James A., Ph.D., U. of Michigan. Prof., Education
Durst, Richard A., Ph.D., Massachusetts Institute of Technology. Prof., Food Science and Technology (Geneva)
Duxbury, John M., Ph.D., U. of Birmingham (England). Prof., Crop and Soil Sciences
Earle, Elizabeth D., Ph.D., Harvard U. Prof., Plant Breeding
Eberts, Paul R., Ph.D., U. of Michigan. Prof., Rural Sociology
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